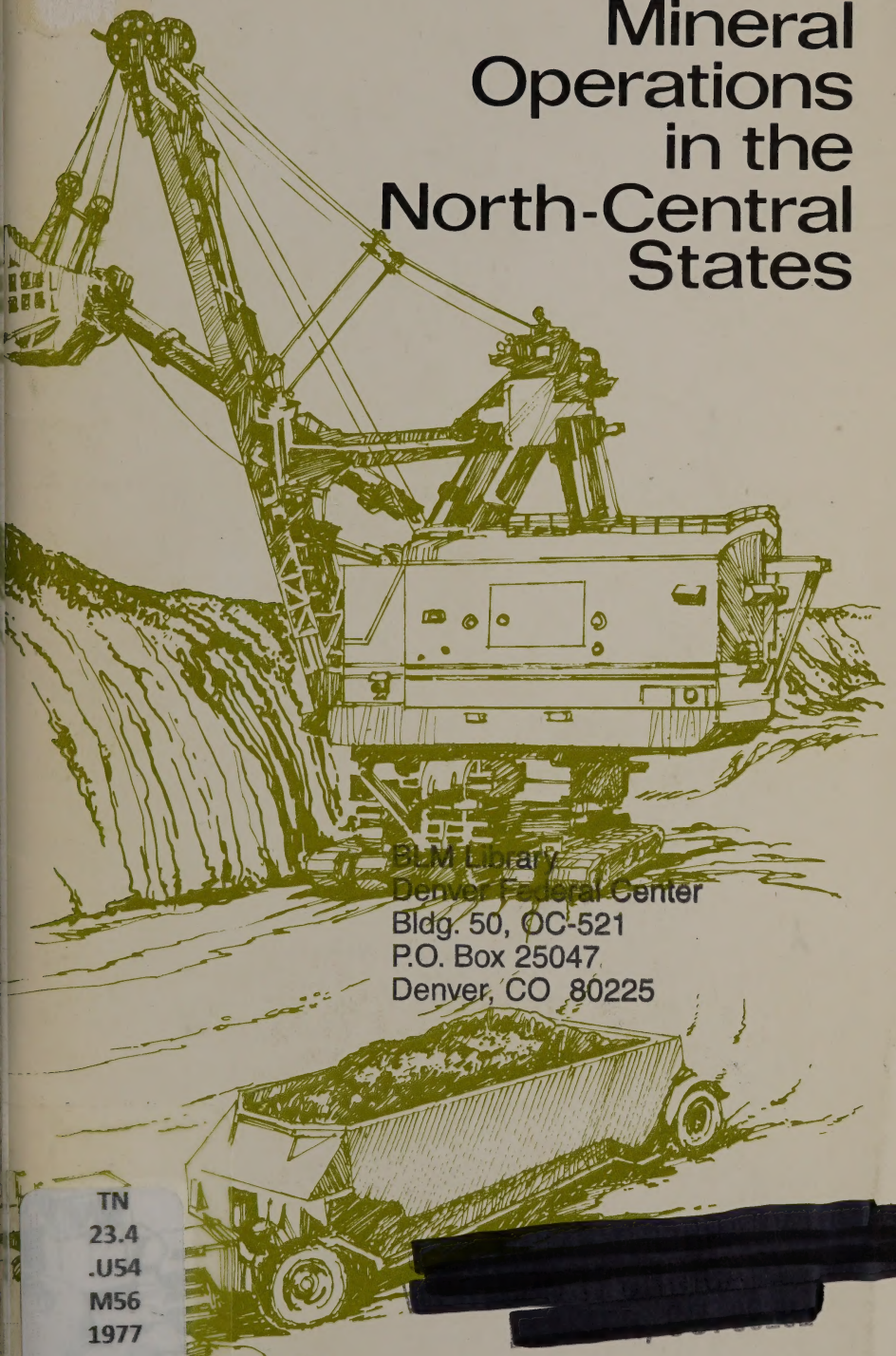
BLM LIBRARY
88077281

Mining and Mineral Operations in the North-Central States



BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

TN
23.4
.U54
M56
1977

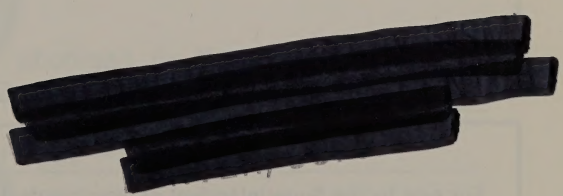
A Visitor Guide

88077281
#3069618
TN
23.4
.U54
M56
1977

MINING AND MINERAL OPERATIONS IN THE NORTH-CENTRAL STATES

A VISITOR GUIDE

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225



BY BUREAU OF MINES STATE LIAISON OFFICERS

1977

This publication has been cataloged as follows:

United States. Bureau of Mines.

Mining and mineral operations in the North-Central States; a visitor guide, by Bureau of Mines State Liaison Officers. [Washington]: Bureau of Mines, [1977]

120 p. illus. (*Its* Special publication)
Includes bibliographies.

1. Mines and mineral resources—Middle West—Guide-books. I. Title. (Series: United States. Bureau of Mines. Special publication—Bureau of Mines)

HD9606.U63U65 622.06173

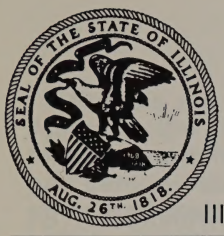
☆ U.S. GOVERNMENT PRINTING OFFICE : 1977 O—227-811

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
Stock No. 024-004-01897-6

CONTENTS

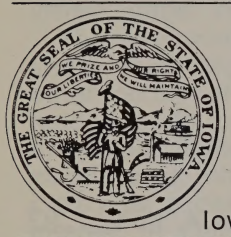
Page

Introduction 1



Illinois, by Thomas O. Glover 5

Indiana, by William S. Miska 17



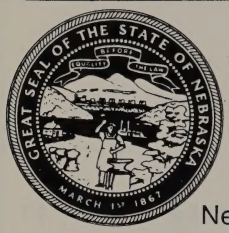
Iowa, by Joseph C. Arundale 25

Kansas, by Harry F. Robertson 37

Michigan, by Edward C. Peterson and Esther A. Middlewood 43

Minnesota, by Wesley A. Grosh 53

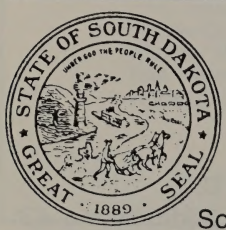
Missouri, by Joseph C. Arundale . . . 61



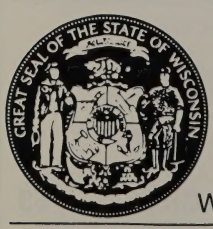
Nebraska, by Harry F. Robertson . . . 79

North Dakota, by Charles A. Koch . . 87

Ohio, by William S. Miska 95



South Dakota, by James H. Aase . . 105



Wisconsin, by Wesley A. Grosh . . . 113

INTRODUCTION

Minerals are vital to any industrialized civilization. Annually, the United States uses more than 4 billion tons of new mineral materials, or about 40,000 pounds per person—about half being mineral fuels and the other half metals and nonmetallics. Stable and economic domestic mining, mineral, metal, and mineral reclamation industries are essential to the economy. The value of United States energy and processed materials of mineral origin exceeds $200 billion annually. Although a number of minerals are imported, especially some designated as "strategic and critical," most U.S. mineral supplies are derived from the domestic mines and processing facilities that you will be seeing, reading about, and visiting as you use this visitor guide. We hope you enjoy your experiences.

This pamphlet, a guide to mining and mineral operations that may be observed or visited and some other points of interest relating to minerals, is intended to aid tourists and students who are interested in mining. Some may wish to study our Nation's romantic past; others may plan to enter the minerals industry as a career; still others may have a primary interest in conservation practices. The pamphlet is also intended to aid State and local officials, Chambers of Commerce, and mining firms in answering some of the many questions of tourists and students.

Six visitor guides have been prepared covering mining operations in the United States. The regions covered by these guides are the New England and Mid-Atlantic States, the South Atlantic States, the North-Central States, the South-Central States, the Rocky Mountain States, and the Pacific States.

The text provides interesting highlights about mines and mineral operations that travelers may see from the highways. Longer descriptions of mines and plants that can be visited sometimes are provided. The mines mentioned are representative samples and are those most easily observed from, or are near, major highways. There are many others that are operating but are more remote. Selected references for detailed study are also included.

The Bureau of Mines publishes a Minerals Yearbook each year that summarizes the national production and status of each mineral commodity. The mineral industry production and status for each State are described in separate chapters. The Yearbook may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Separate chapters are available free from Publications Distribution Branch, Bureau of Mines, U.S.

Department of the Interior, 4800 Forbes Avenue, Pittsburgh, Pa. 15213.

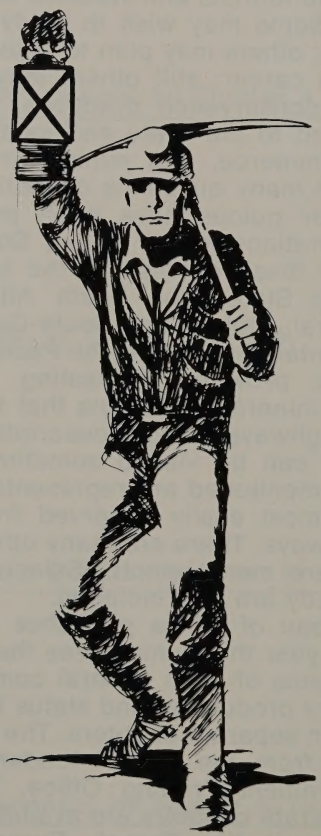
Students who have a deep interest in some branch of mining will find most mine managers willing to help, even though the mine may not be open to casual tourists.

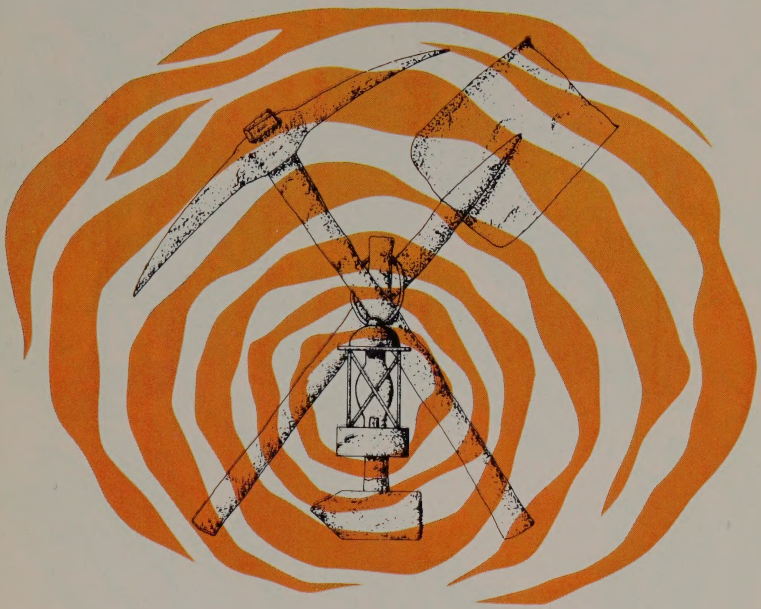
If you leave well-traveled highways to visit ghost towns, tell someone where you are going and when you expect to get back. You should also inquire locally about road conditions before traveling unpaved or unimproved roads.

Bring your camera. Many prize-winning photographs have been obtained at the areas mentioned in this pamphlet.

ACKNOWLEDGMENTS

Acknowledgments are due those who helped prepare this pamphlet. State geologists, State Offices of Information, Chambers of Commerce, mine managers, and Bureau personnel have freely contributed data.





CAUTION

Remember that abandoned mines are death traps. Stay out of them. Old shafts often cave near the surface and form a funnel-shaped opening. Unwary visitors have been trapped in these funnels. Stay away from old shafts!

Always use available guide services. Mine openings (tunnels, adits, open pits) should never be entered except with a competent guide.

Sometimes the air is bad in abandoned mines and is not safe to breathe. Explosive gas may also be present. Gases frequently come from the rocks themselves, but during active operations, they are swept out of the mine by the controlled ventilating current.

Remember, too, that even the oldest mines usually are private property. Most mine owners do not object to the collection of a few mineral specimens (some do charge a fee), but all object to touring vandals, who wantonly destroy buildings and equipment, or to inexperienced trespassers, who present a hazard to themselves, the property, and the owners.

ILLINOIS

by
Thomas O. Glover

The principal minerals produced in Illinois, in order of value, are coal, petroleum, stone, and sand and gravel. The State ranks first in the Nation in production of fluorspar, second in stone production, fourth in sand and gravel production, and fourth in coal output. Coal was discovered in Illinois in the 1670's; however, the first million-ton production year was in 1864. The first mining of coal took place in 1810 near Murphysboro in Jackson County. The first production of natural gas occurred in 1853 near Champaign in Champaign County. Commercial-quality oil was first discovered in 1906 near Casey in Clark County. Fluorspar was first discovered at Rosiclare in Hardin County in 1818 but was not mined until 1842. Lead has been mined at Galena in Jo Daviess County area since the year 1700.

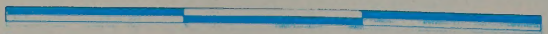
MINES AND PLANTS YOU CAN SEE FROM THE HIGHWAY

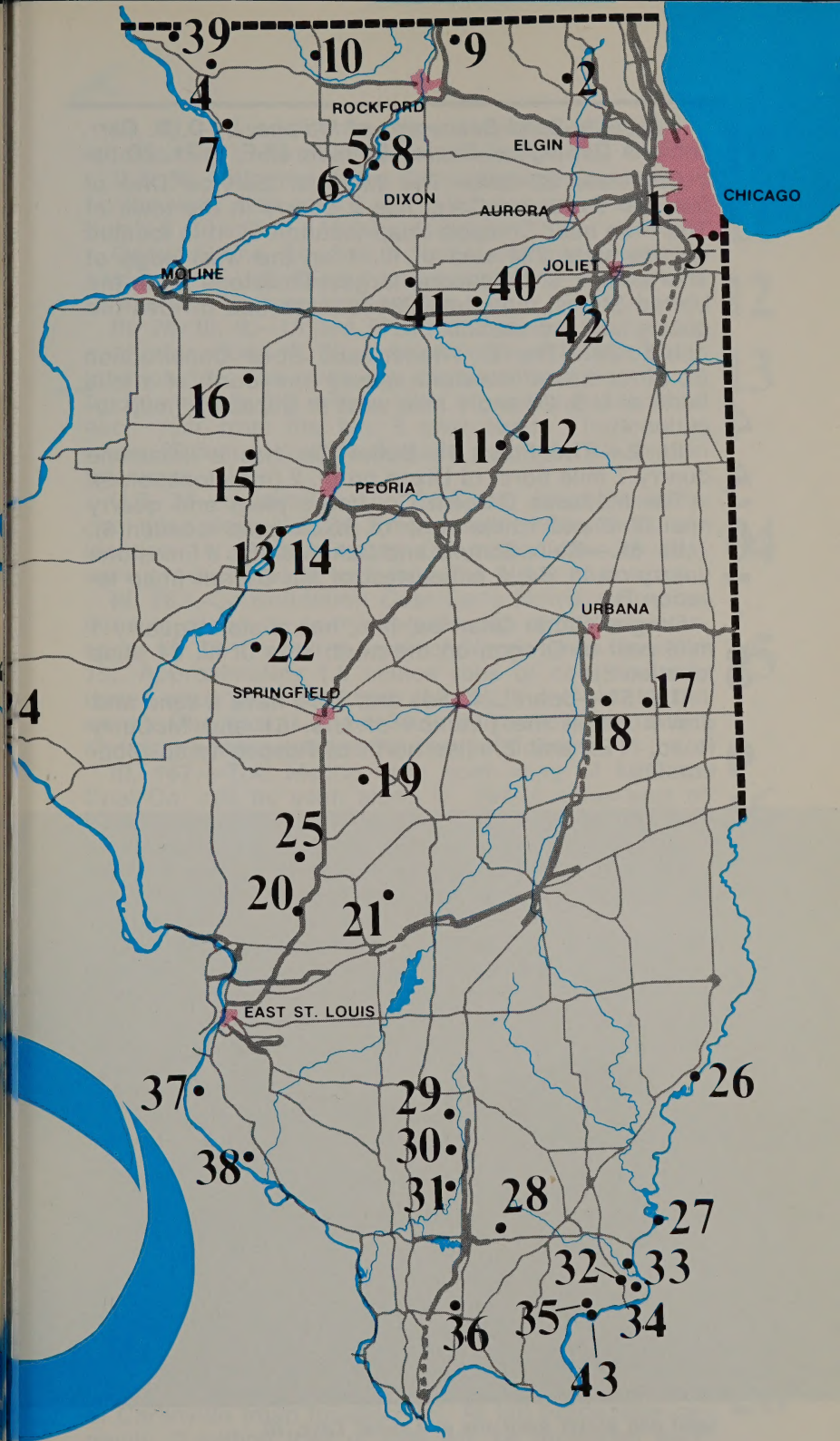
U.S. 66.—The Midwest Div. of Vulcan Materials Co. has a limestone quarry 15 miles southwest of Chicago's Loop area on U.S. 66 in McCook (map location 1). This quarry has been in operation since the turn of the century and now covers 650 acres. The designed capacity of the plant is 2,200 tons per hour, and annual production is in excess of 5 million tons. On the property are a lime plant, mineral filler plant, ready mix concrete plant, pipe plant, and three asphalt plants that draw their material needs from the quarry. 1

U.S. 14.—The Midwest Div. of Vulcan Materials Co. has a sand and gravel plant 1 mile east of Crystal Lake, on U.S. Highway 14 (map location 2). This is approximately 42 miles northwest of Chicago's Loop area. The pit was opened in the early 1940's, and a modern plant was erected in 1957 with a designed capacity of 750 tons per hour and annual production in excess of 1½ million tons. 2

LEGEND

1— Limestone quarry
2— Sand and gravel plant
3— Limestone quarry
4— Limestone quarry
5— Limestone quarry
6— Limestone quarry
7— Limestone quarry
8— Limestone quarry
9— Sand and gravel pit
10— Limestone quarry
11— Limestone quarry
12— Limestone quarry
13— Strip coal mine
14— Strip coal mine
15— Strip coal mine
16— Strip coal mine
17— Underground coal mine
18— Limestone quarry
19— Underground coal mine
20— Underground coal mine
21— Underground coal mine
22— Limestone quarry
23— Underground limestone mine
24— Underground limestone mine
25— Limestone quarry
26— Underground coal mine
27— Coal dock
28— Underground coal mine
29— Underground coal mine
30— Underground coal mine
31— Underground coal mine
32— Underground fluorspar mine
33— Underground fluorspar mine
34— Limestone quarry
35— Fluorspar concentrating plant
36— Limestone quarry
37— Underground limestone mine
38— Underground limestone mine
39— Vinegar Hill Lead Mine and Museum
40— Ottawa Silica Quarry Overlook
41— Mine disaster monument
42— Mine disaster monument
43— Hardin County Fluorspar and General Museum




39
10
9
2
4
ROCKFORD
7
5
8
ELGIN
6
DIXON
AURORA
CHICAGO
1
3
MOLINE
JOLIET
40
41
42
16
11
12
15
PEORIA
13
14
URBANA
22
SPRINGFIELD
17
18
19
25
20
21
EAST ST. LOUIS
37
29
26
30
38
31
28
27
32
33
36
35
34
43

Specialty Sand Resources of Indiana, by D. D. Carr. Indiana Geological Survey Bulletin 42-F, 1971, 30 pp.

3 **Interstate 80–294.**—The Material Service Div. of General Dynamics Corp. has a quarry in the town of Thornton near Chicago (map location 3). It is located on Interstate 294 east of Ill. 1 on the west edge of Thornton. It is the second largest limestone pit in the United States. Interstate 294 crosses and divides the quarry into two sections.

4 **U.S. 20.**—The E. Wienen and Sons Construction Co., Inc., has a limestone quarry one-fourth of a mile north of U.S. 20 and 1 mile west of Elizabeth (map location 4).

5 **Ill. 2.**—The Frank N. Butler Co. has a limestone quarry 1 mile north of Dixon on Ill. 2 (map location 5).

6 The Medussa Cement Co. has a plant and quarry near Ill. 2 and 1 mile north of Dixon (map location 6).

7 **Ill. 64.**—Rein, Schultz and Dahl Inc. has a limestone quarry on Ill. 64, 2 miles west of Mt. Carroll (map location 7).

8 Oregon Stone Quarries, Inc., has a stone quarry 1 mile east of Oregon on the north side of Ill. 64 (map location 8).

9 **U.S. 51.**—John L. Kelley and Sons have a sand and gravel pit at the junction of U.S. 51 and McCurry Road, N.E., and 2 miles north of Roscoe (map location 9).

Sand and gravel plant site at Crystal Lake, Ill.

Ill. 73.—Russell E Cox has a limestone quarry 1 mile north of Lena on Ill. 73. (map location 10). 10

U.S. 66.—Wagner Stone Co. has a limestone quarry on the west side of U.S. 66, 5.9 miles south of junction U.S. 66 and Ill. 116 (map location 11). 11

Ocoya Stone Co. has a limestone quarry on the east side of U.S. 66, 5.4 miles south of junction U.S. 66 and Ill. 116 (map location 12). 12

Ill. 78, Ill. 9.—United Electric Coal Co. has a strip coal mine along Ill. 78, 6 miles south of Canton (map location 13). The mine can be seen best from Ill. 9. Approximately 1.6 million tons of coal are produced each year from the No. 5 coal seam. The coal is under 60 feet of overburden and averages 4½ feet in thickness. 13

U.S. 24—United Electric Coal Co. closed its strip coal mine along U.S. 24, 2 miles west of Glasford (map location 14). Approximately 0.6 million tons of coal were produced each year from the No. 2 coal seam. 14

Ill. 78.—Consolidation Coal Co.'s Norris strip coal mine is along an unmarked county road that intersects Ill. 78 1½ miles west of Norris (map location 15). Approximately 1.5 million tons of coal are produced each year from both the No. 5 and No. 6 coal seams. The coal is under 30 to 80 feet of overburden and each seam averages 3½ feet in thickness. 15

Ill. 167.—The Mecco strip coal mine of Midland Coal Co. can be seen along Ill. 167, 2 miles east of Victoria (map location 16). See mine from Ill. 180. Approximately 1.5 million tons of coal are produced each year from the No. 6 coal seam. The coal averages 3½ feet in thickness and is under 58 feet of overburden. 16

U.S. 36.—Zeigler Coal Co. has an underground coal mine along U.S. 36, 1½ miles east of Murdock (map location 17). Approximately 1 million tons of coal are produced each year from the No. 6 coal seam. The mine is 207 feet deep, and the coal seam averages 7 feet in thickness. 17

Tuscola Stone Co. has a limestone quarry on the south side of U.S. 36, 1½ miles east of Tuscola (map location 18). 18

Ill. 104.—Peabody Coal Co. has an underground coal mine along Ill. 104, 4 miles east of Pawnee (map location 19). Approximately 4 million tons of coal are produced each year from the No. 6 coal seam. The mine is 340 feet deep, and the coal seam averages 7 feet 2 inches in thickness. The mine has a mine-mouth powerplant, owned by Commonwealth Edison Co., that it supplies with coal. 19

Ill. 4.—Monterey Coal Co. has an underground coal mine, located 3 miles west of Ill. 4 and 5 miles south of Carlinville (map location 20). At full production capacity, 3 million tons of coal will be produced each 20

This quarry at Thornton, Ill., produces limestone.

year from the No. 6 coal seam. The mine is 300 feet deep, and the coal seam averages 7 feet 3 inches in thickness.

21 **Ill. 185.**—Consolidation Coal Co. has an underground coal mine approximately 3½ miles south of Ill. 185 at Coffeen (map location 21). Over 1 million tons of coal are produced each year from the No. 6 coal seam. The mine is 354 feet deep, and the coal seam averages 7 feet 6 inches in thickness. The mine has a mine-mouth powerplant, owned by the Central Illinois Public Service Co., that it supplies with coal.

22 **Ill. 29.**—Iola Stone and Material Co. has a limestone quarry, 4 miles northeast of Athens, along the east side of Ill. 29 (map location 22).

23 **Ill. 57.**—Marblehead Lime Co. has an underground limestone mine, approximately 2 miles south of Quincy, along the east side of Ill. 57 (map location 23).

24 The Calcium Carbonate Co. and Space Center Quincy, Inc., have operations underground in the Calcium Carbonate Co. quarries, which are located 3 miles south of Quincy on Ill. 57 (map location 24). Calcium Carbonate Co. removes the limestone by the room-and-pillar mining method. This limestone is used as an essential ingredient in glass, asphalt, animal feed, building products, putty, concrete, plastics, paints, adhesives, rubber, soil treatments, etc. Space Center Quincy, Inc., is a licensed warehousing company. Its warehouses are located in the mined-out areas of the underground operations. The underground warehouses are serviced daily by the Burlington Railroad and continuously by large trucks. Presently such items as foodstuffs, air filters, paper bags, and picnic coolers are being stored in the underground warehouses.

Ill. 108.—Midstate Stone, Inc., has a limestone quarry, 8 miles west of Carlinville, along the north side of Ill. 108 (map location 25). 25

Ill. 1.—Amax Coal Co. has an underground coal mine approximately 1 mile east of Keensburg (map location 26). Ground breaking for the new mine began in May 1971. When full production is reached, the mine will produce 3.6 million tons of coal per year. The coal seam is reached through a 2,600-foot, 17-foot-diameter bored, 17½° slope. The 8-foot No. 6 coal seam is under 750 feet of cover. 26

Ill. 13.—Peabody Coal Co. has a coal dock on the Ohio River near Old Shawneetown, one-fourth of a mile south of Ill. 13 (map location 27). The dock receives coal from Peabody's mines, Eagle 1, Eagle 2, and Eagle strip mines, all located in the near vicinity of the dock. The coal is received from the mines, stored in a common storage area, and then is transported by conveyors overland to the dock loading. Eagle No. 1, drift mine, opened in 1967 into the No. 5 coal seam, which is 4½ feet thick. Eagle No. 2, a slope mine, opened in 1969 into the No. 5 coal seam, which is 4½ feet thick under 250 feet of cover. Eagle strip mine, opened in 1966, is mining two seams. The Dekoven, under 45 feet of overburden, and the Davis, under 70 feet of overburden, are both mined. Approximately 3 to 4 million tons of coal per year are shipped through the dock from the three mines. 27

In the mined-out sections of this underground limestone operation is the Space Center Quincy, Inc., warehouse.

28 Sahara Coal Co. has an underground coal mine approximately 8 miles west of Harrisburg and one-fourth mile south of Ill. 13 (map location 28). The mine, opened in 1971, is into the No. 5 coal seam. The 52-inch seam is 240 feet below the surface. Production is approximately 4,000 tons of coal per day. Both mine No. 20 (located north of Ill. 13) and mine No. 21 transfer their coal to a preparation plant by an overland belt conveyor. The plant is approximately 3 miles south of Ill. 13.

29 **Ill. 148.**—Freeman Coal Mining Corp. has an underground coal mine, one-half mile south of Waltonville and one-half mile east of Ill. 148 (map location 29). Approximately 8,000 tons of coal per day is produced from the 84-inch No. 6 coal seam. The mine opened in 1968 and is 792 feet deep.

30 Inland Steel Co. has an underground coal mine, approximately 4½ miles south of Waltonville and one-fourth mile east of Ill. 148 (map location 30). Approximately 11,000 tons of coal per day is produced from the 108-inch No. 6 coal seam. The mine opened in 1966 and is 733 feet deep.

31 **Ill. 183.**—Old Ben Coal Corp. has an underground coal mine, approximately 2 miles east of Sesser and three-fourths of a mile south of Ill. 183 (map location 31). Approximately 10,000 tons of coal per day is produced from the 96-inch No. 6 coal seam. The mine opened in 1968 and is 651 feet deep.

32 **Ill. 146.**—An underground fluorspar mine and mill operated approximately 1.6 miles west of Ill. 1 and 1.4 miles north of Ill. 146 (map location 32). Due to the fact that the mine is in the Shawnee National Forest, the mine can be seen only from Ill. 146, and then only when the foliage is off the trees. Until its closing, the mine produced approximately 2,000 tons of fluorspar per month from approximately 10,000 tons of mined material.

33 **Ill. 1.**—Minerva Co. has an underground fluorspar mine and mill, approximately 3.6 miles north of Ill. 146 and one-half mile east of Ill. 1 (map location 33). The mine is in the Shawnee National Forest and can be seen only when the foliage is off the trees. The mine produces approximately 5,500 tons of fluorspar per month, from approximately 27,500 tons of mined material.

34 Denny and Simpson Stone Co. has a limestone quarry and mill north of Ill. 146 and west of Ill. 1 (map location 34). The site is close to the intersection of Ill. 1 and 146. You can see the site from Ill. 1.

35 **Ill. 34.**—Ozark-Mahoning Fluorspar Co. has a fluorspar concentrating plant on the north city limits of Rosiclare and 0.2 mile east of Ill. 34 on Bohn Street (map location 35). The plant can be seen from Ill. 34 where the railroad crosses the highway into the plant.

Ill. 37.—Southern Illinois Stone Co. has a limestone quarry and mill, approximately 1 mile north of Buncombe and on the east side of Ill. 37 (map location 36). 36

Ill. 156.—Columbia Quarry Co. has an underground limestone mine on the north edge of Valmeyer north of Ill. 156 (map location 37). 37

Ill. 155.—Allied Chemical Corp. has an underground limestone mine, along a county road approximately 1½ miles north of Prairie du Rocher, north of Ill. 155 (map location 38). 38

MINES YOU CAN VISIT

Ill. 84.—The Vinegar Hill Lead Mine and Museum is owned by Earl Furlong of Galena. The site is located 6 miles north of Galena and 0.4 mile east of Ill. 84 (map location 39). The claim was first worked by the Furlong family back in 1824. There is a lead crevice approximately 50 feet deep and 300 feet in length underground. The museum has primitive tools of early mining days. A picnic and rest area are available at the mine site. The mine and museum are open daily from Memorial Day to Labor Day and weekends only in May, September, and October. The mine has been approved as safe by the State Department of Mines and Minerals. 39

Ill. 6.—Ottawa Silica Co. has constructed an overlook at its quarry located on Boyce Memorial Drive, seven blocks south of Ill. 6 (map location 40). It offers a scenic view to thousands of visitors each year, giving them a first-hand look into the famous Ottawa Silica Quarry. The 32-foot-square pavilion is constructed of natural redwood. In a striking panorama, the visitors see an area encompassing 190 acres. The deepest point is 120 feet, with a water depth of 35 to 40 feet. During the quarry's 41 years of active mining life, nearly 40 million tons of silica sand were removed. 40

GHOST TOWNS AND HISTORICAL SITES

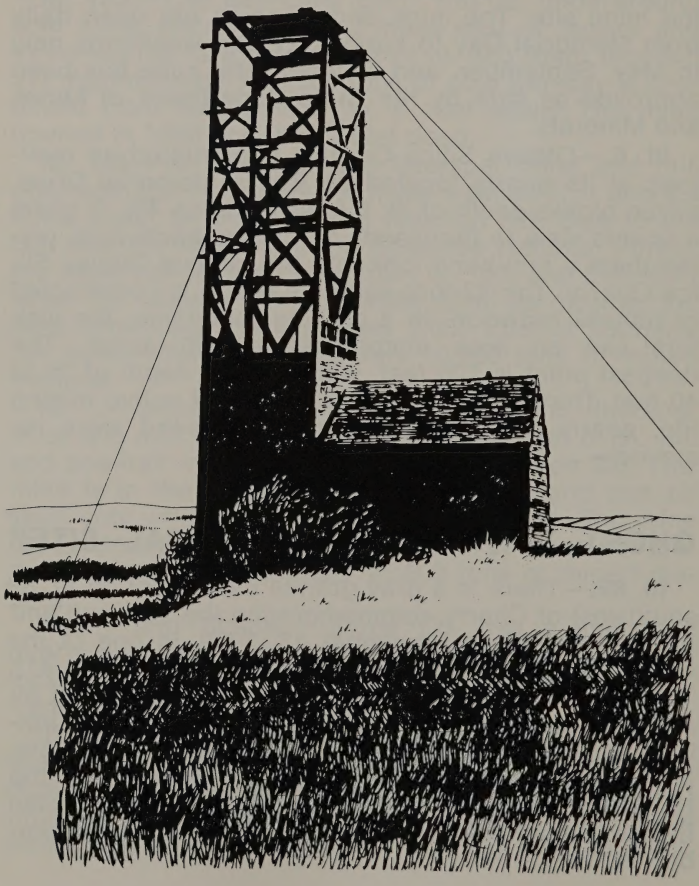
Ill. 89.—There is a gray granite monument on Ill. 89 southwest of Cherry commemorating the 259 men and boys who died on November 13, 1909, in one of the worst mine fire disasters in history (map location 41). The fire started when a pit car of hay was ignited by a blazing open torch used to illuminate the shaft bottom, causing overhead timbers to be ignited. The memorial monument and cemetery are located at the Holy Trinity Church site. The monument was erected by the United Mine Workers of America on November 13, 1911. 41

Ill. 113.—On the north side of Ill. 113-S in the village of Diamond, 1 mile west of Interstate 55, is a monument that commemorates the 69 men and boys who died in the flooded underground Diamond coal mine (map location 42). On February 16, 1883, a great pocket of accumulated surface water over the mine broke through into the mine near the main shaft. The mine was only 84 feet deep at the main shaft where the water broke through. One hundred sixteen miners were rescued. Of the 69 who died, the bodies of only 28 were recovered. The monument now stands over the place where the others are believed to have died.

42

Ill. 34.—Hardin County Fluorspar and General Museum, Inc., is located in Rosiclare, approximately two blocks south of the end of Ill. 34, in the old Rosiclare hospital building (map location 43). It is operated as a nonprofit organization and consists of a series of exhibit rooms that display fluorspar specimens, historical documents, photographs of old mining operations, old records and notices, and old fluorspar mining equipment.

43



FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, 504 East Monroe Street, Room 1117, Ridgely Building, Springfield, Ill. 62701.

Illinois State Geological Survey, Natural Resources Building, Urbana, Ill. 61801.

Illinois State Department of Mines and Minerals, Room 704, State Office Building, Springfield, Ill. 62706.

SELECTED REFERENCES

Annual Coal, Oil and Gas Report. Illinois State Department of Mines and Minerals, Room 708, State Office Building, Springfield, Ill. 62706.

Educational Series–8—Industrial Minerals and Metals of Illinois. Illinois State Geological Survey, Natural Resources Building, Urbana, Ill. 61801.

Educational Series 9—Inside Illinois. Mineral Resources. Illinois State Geological Survey, Natural Resources Building, Urbana, Ill. 61801.

Indiana's scenic beaches are a mecca for swimmers, fishermen, and boating enthusiasts, putting recreation alongside concentrated industry.

INDIANA

by
William S. Miska

The mineral industries in Indiana produce coal, stone, sand, gravel, petroleum, natural gas, clays, gypsum, and peat. In addition, cement is manufactured from locally produced limestone and clays, whereas lime, iron, steel, and aluminum are manufactured from imported mineral materials.

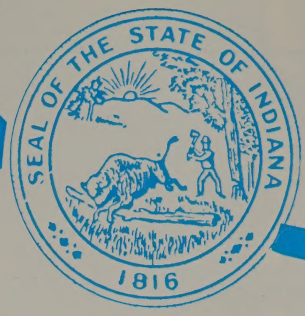
All of Indiana's coal mines and most of its producing petroleum and natural gas wells are found in the southwestern part of the State. Crushed limestone quarries and sand and gravel pits are widely scattered throughout the State. The famous Salem Limestone dimension stone quarries are located in a narrow belt extending from Bloomington to Bedford in west southcentral Indiana.

The use of Salem Limestone, now generally known as Indiana Limestone, as building stone or dimension stone dates back to the 1820's. Limestone quarrying is one of the oldest industries in the State, and Indiana has dominated the Nation's domestic dimension limestone market since the late 1800's. Thousands of buildings throughout the eastern half of the United States, including many mansions, churches, post offices and schools, have been constructed of Indiana Limestone. The stone became the official stone of the State of Indiana through legislative action by the Indiana General Assembly in 1971.

MINES AND PLANTS YOU CAN SEE FROM THE HIGHWAY

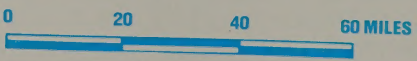
U.S. 12.— U.S. 12 in Gary, East Chicago, and Whiting, passes along the southern edge of Lake Michigan through one of the most highly industrialized areas of the Nation (map location 1). Here are located many industries dependent on minerals and fuels such as ironworks and steelworks, coke plants, petroleum refineries, a cement plant, powerplants, smelters, and foundries. A panorama of giant plants, huge tanks,

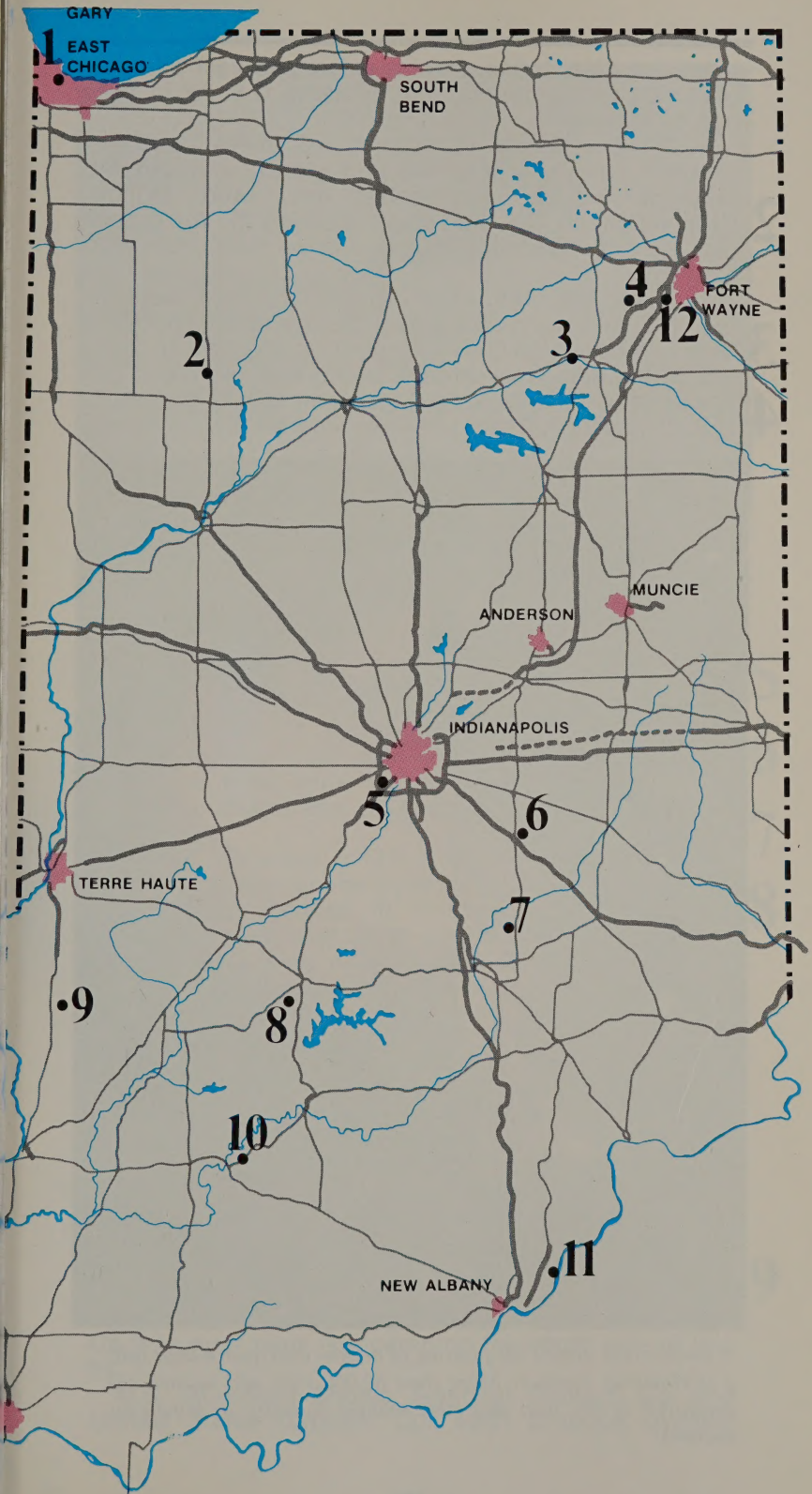
1



LEGEND

1— Mineral processing plants: Steel mills, petroleum refineries, cement works, etc.
2— Limestone quarries and processing plants
3— Sand and gravel pit
4— Sand and gravel pit
5— Sand and gravel pit
6— Sand and gravel pit
7— Limestone quarry
8— Limestone quarries
9— Coal mines
10— Gypsum mines
11— Limestone crushing and barge loading facilities
12— Limestone quarry




GARY
1
EAST CHICAGO
SOUTH BEND
4
FORT WAYNE
12
2
3
MUNCIE
ANDERSON
INDIANAPOLIS
5
6
TERRE HAUTE
7
9
8
10
11
NEW ALBANY

mazes of pipe, trains, trucks, ships, and vast piles of materials and products unfolds along U.S. 12 in this part of Indiana.

U.S. 421.—South of Monon 1.5 miles are the crushed limestone quarries and plants operated by Western Indiana Aggregates, Inc., and Monon Crushed Stone Co., Inc. (map location 2). An excellent view of Western's quarry can be seen from the highway.

2

U.S. 24, Ind. 105.—On U.S. 24, 0.3 mile west of Ind. 105, is a sand and gravel plant and pit operated by H & W Sand and Gravel Corp. (map location 3).

3

U.S. 24, Ind. 114.—A sand and gravel plant and pit operated by W & W Sand, Stone and Gravel Co. is on U.S. 24 just east of Ind. 114 (map location 4).

4

A steelworker directs the pouring of molten iron from a ladle into a steelmaking furnace. More than 60,000 men and women are employed in the iron and steel making industry in northwest Indiana.

The main library at Indiana University, Bloomington, Ind., is an example of the use of Indiana dimension limestone.

Ind. 37, Interstate 465.—Just north of junction Ind. 37 and Interstate 465 on the south side of Indianapolis is a large sand and gravel processing plant operated by American Aggregates Corp. (map location 5). 5

Ind. 9.—Sand and gravel plant and pits operated by Indiana Gravel Co. can be seen between Interstate 74 and Shelbyville (map location 6). 6

On the west edge of Norristown is the crushed limestone quarry and plant of Cave Stone, Inc. (map location 7). 7

Ind. 37.—Visitors to the Bloomington-Bedford area may notice spectacular pyramids made of large stone blocks (map location 8). These pyramids of waste stone mark the location of abandoned and active dimension limestone quarries producing Indiana Limestone for use as building stone. Numerous quarries and finishing mills are in the area. The quarries close during the winter months but most mills operate year round. The mill and quarries operated by Woolery Stone Co. can be viewed from Tapp Road, 0.7 mile east of its intersection with Ind. 37, on the southwest side of Bloomington. Inquire locally for directions to other mills and quarries. 8

Ind. 54.—Various phases of surface coal mining activities including scenes of past and present land reclamation practices can be viewed along Ind. 54 between the small town of Dugger and U.S. 41 (map location 9). Amax Coal Co. operates its Minnehaha mine on the north side of Ind. 54 and Peabody Coal Co.'s Dugger mine is located on the south side of Ind. 54. 9

U.S. 50.—Near Shoals, National Gypsum Co. and United States Gypsum Co. each produce gypsum

United States Gypsum Co. operations at Shoals, Ind.

10 from underground mines (map location 10). National Gypsum Co.'s gypsum products plant is located on U.S. 50, 2.5 miles east of intersection of U.S. 50 and U.S. 150. United States Gypsum Co.'s facilities are located on Ind. 650, about 1 mile south of U.S. 50.

11 **Utica Pike.**—Martin Marietta Corp.'s limestone crushing and barge loading facilities on the Ohio River are located 1 mile north of Utica (map location 11). Somewhat off the beaten path, the drive from Jeffersonville, across the Ohio River from Louisville, Ky., to Utica offers many fine views of the Ohio River.

A big ship lumbers into Indiana Harbor, one of the busiest dock areas on Lake Michigan in northwest Indiana.

MINES YOU CAN VISIT

U.S. 24.—One of the deepest limestone quarries in Indiana is located on Sand Point Road, 2 miles southwest of Fort Wayne (map location 12). May Stone and Sand, Inc., has erected an observation platform on the very edge of this 300-foot-deep quarry that gives an outstanding view of the quarry and part of the stone processing facilities. To get to the quarry from U.S. 24, turn south on Ardmore Avenue, which intersects U.S. 24 just east of its junction with Ind. 14. Proceed south 3 miles on Ardmore Ave., turn west on Sand Point Road and follow signs to observation platform. 12

Clubs and organizations wishing to arrange tours of surface coal mines may contact the Indiana Coal Association, 632 Cherry Street, Terre Haute, Ind. 47801.

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, Seventh and College Streets, Bloomington, Ind. 47401.

Indiana Bureau of Mines and Mining, 1119 Wabash Avenue, Terre Haute, Ind. 47807.

Indiana Geological Survey, 611 North Walnut Grove, Bloomington, Ind. 47401.

Reclamation Office, Indiana Department of Natural Resources, P.O. Box 126, Jasonville, Ind. 47438.

SELECTED REFERENCES

Coal Resources of Indiana, by C. E. Wier. Indiana Geological Survey Bulletin 42-I, 1973, 40 pp.

Crushed Stone Aggregate Resources of Indiana, by D. D. Carr, R. R. French, and C. H. Ault. Indiana Geological Survey Bulletin 42-H, 1971, 38 pp.

Dimension Limestone Resources of Indiana, by L. F. Rooney. Indiana Geological Survey Bulletin 42-C, 1970, 29 pp.

Gypsum Resources of Indiana, by R. R. French and L. F. Rooney. Indiana Geological Survey Bulletin 42-A, 1969, 34 pp.

High-Calcium Limestone and High-Magnesium Dolomite Resources of Indiana, by L. F. Rooney. Indiana Geological Survey Bulletin 42-B, 1970, 20 pp.

Marl Resources of Indiana, by W. J. Wayne. Indiana Geological Survey Bulletin 42-G, 1971, 66 pp.

Native Indiana Iron Ores and 19th Century Ironworks, by W. J. Wayne. Indiana Geological Survey Bulletin 42-E, 1970, 25 pp.

Sand and Gravel Resources of Indiana, by D. D. Carr and W. M. Webb. Indiana Geological Survey Bulletin 42-D, 1970, 31 pp.

United States Gypsum Co. underground gypsum mine in a corn-soybean field near Sperry, Iowa.

IOWA

by
Joseph C. Arundale

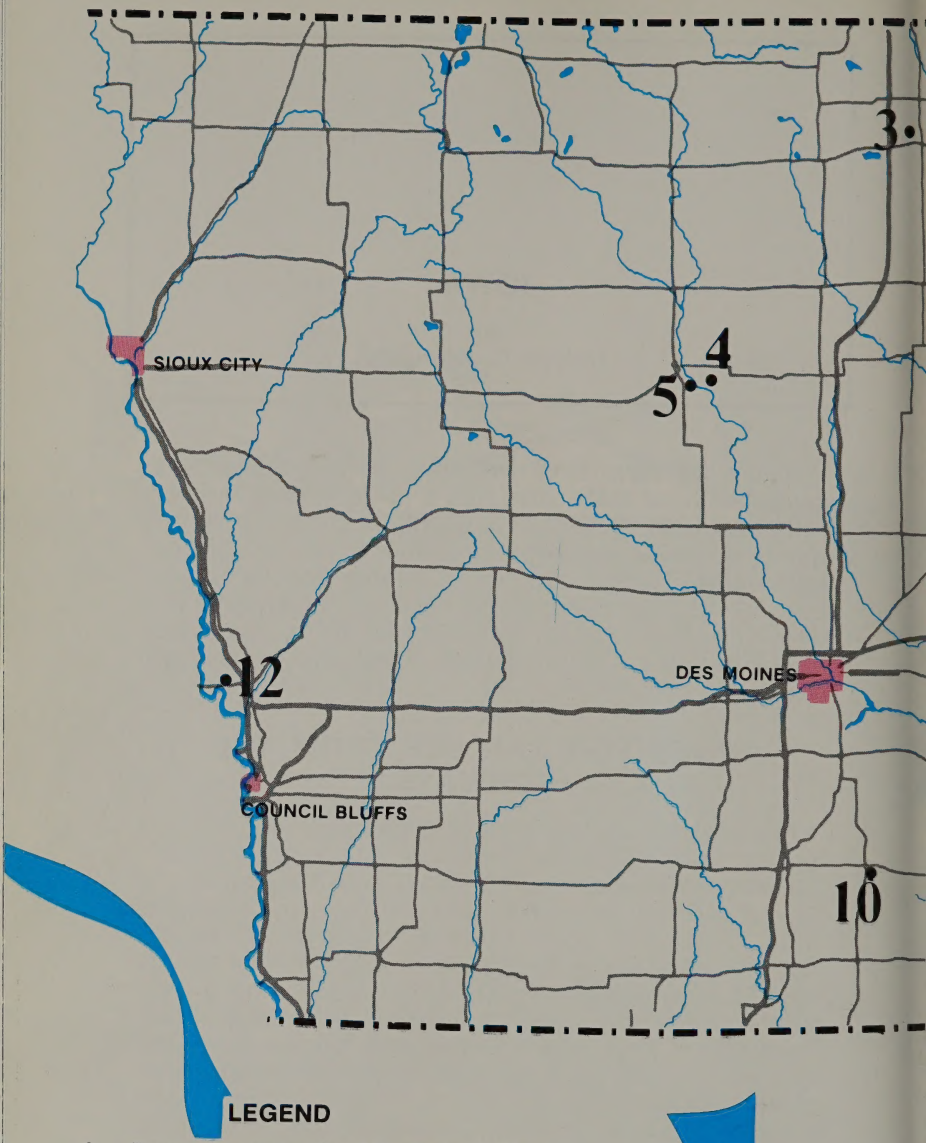
It may be surprising that Iowa, known primarily as an agricultural state, also has a large mining industry with hundreds (600 at last count) of mines, pits, and quarries. Iowa has about one-fourth of the "prime" agricultural land in the United States and its reputation as the "Tall Corn State" is well known and well deserved. But beneath those fertile fields, Iowa also has a buried treasure of coal, sand and gravel, and stone.

MINES YOU CAN SEE FROM THE HIGHWAYS

Many of the mines, pits, and quarries in Iowa can be seen from the major highways.

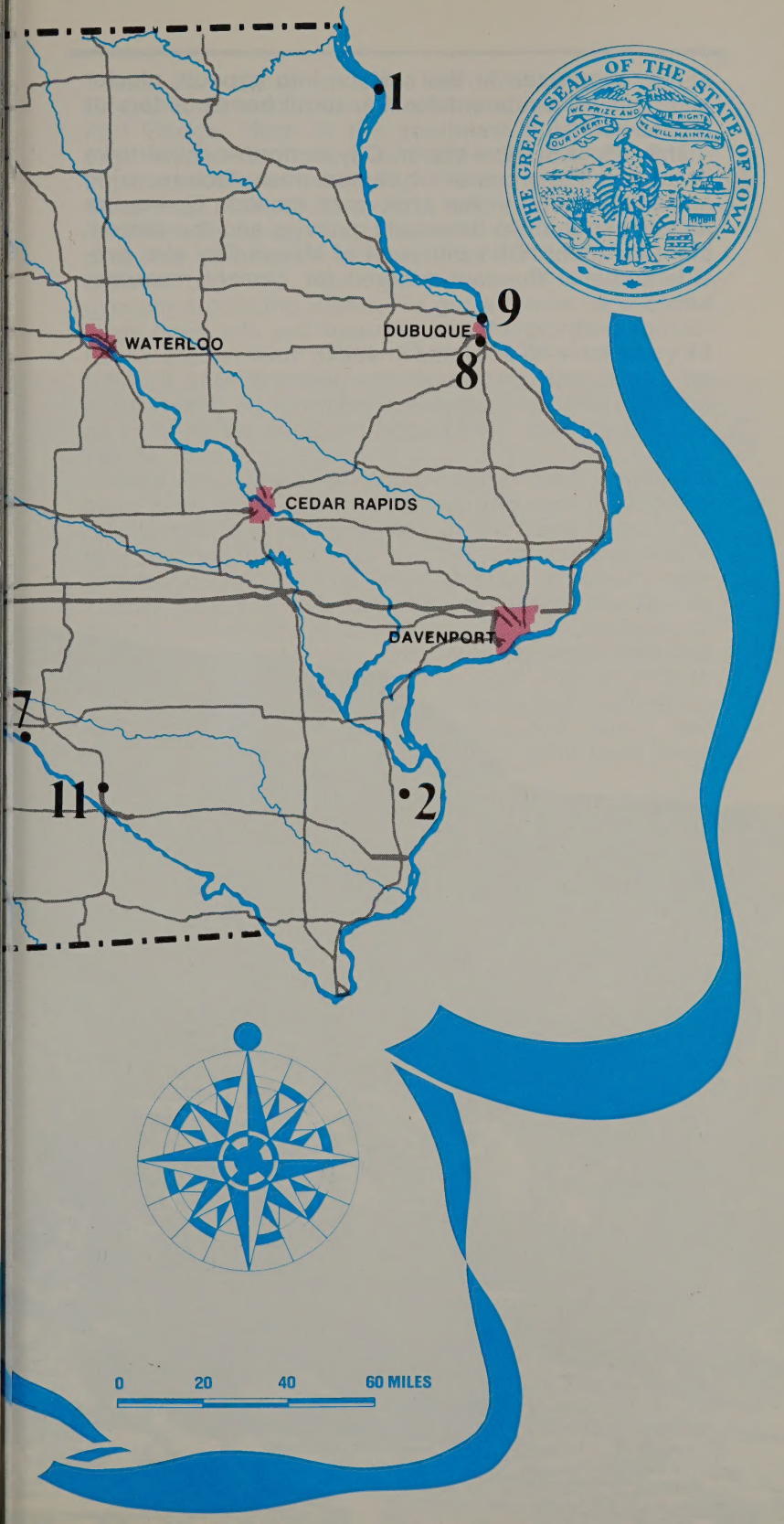
Great River Road.—Running from Canada to the Gulf of Mexico, along the banks of the mighty Mississippi River, the Great River Road is billed as the "longest parkway in the world—5,600 miles of scenic corridor." Marked by an emblem representing a river pilot's wheel with twelve spokes, the Great River Road enters Iowa near Lansing and follows along the Mississippi River to Keokuk in the extreme southeast corner. Driving south on the Great River Road through Dubuque, Clinton, Davenport, and Muscatine, gives the traveler an opportunity to see the many barge tows that ply the Mississippi, carrying agricultural and manufactured products and a huge tonnage and variety of mineral products such as stone, gypsum, salt, cement, iron ore, coal, and petroleum products. (map location 1). At many of the locks or wharfs, you may be able to see the contents of some of these barges.

U.S. 61.—South of Wapello on U.S. 61 (you can pick up the Great River Road again at Burlington) west of the small town of Sperry, can be seen the headframe and surface facilities of the United States Gypsum Co. underground gypsum mine (map location 2). Here, at about 600 feet deep, raw gypsum is mined



LEGEND

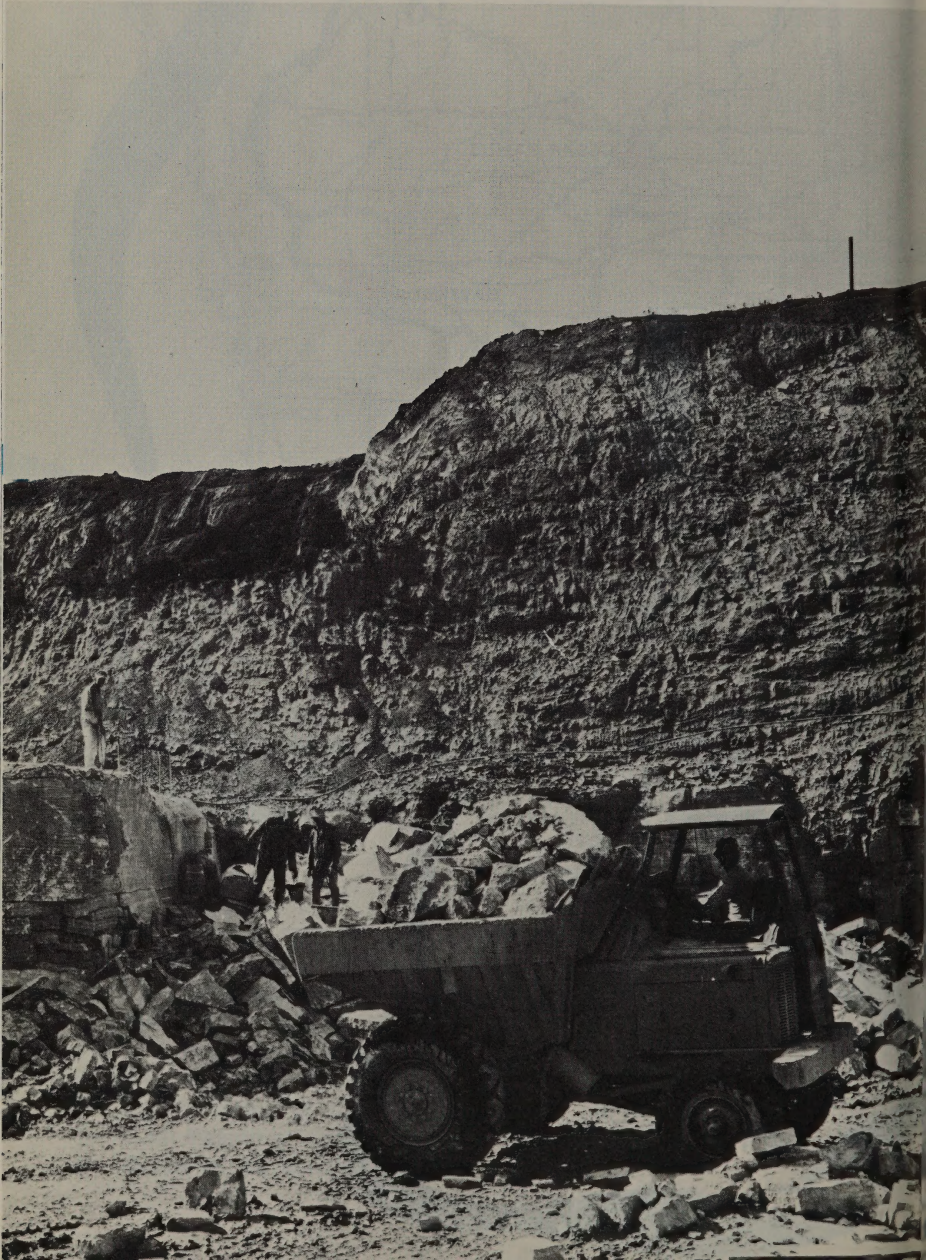
1— Barge tows on the Mississippi River
2— Underground gypsum mine
3— Limestone, cement, and clay activities around Mason City
4— Gypsum area
5— Clay operations
6— Coal mining area—several active and abandoned strip mines
7— Hull mine site demonstration reclamation project
8— Old lead mining district
9— Old shot tower
10— Lucas—home of John L. Lewis
11— Coal Palace at Ottumwa
12— Relics of the sternwheeler Bertrand


1
9
DUBUQUE
8
WATERLOO
CEDAR RAPIDS
DAVENPORT
7
11
2
0
20
40
60 MILES

and is processed at the surface into gypsum plaster and gypsum wallboard familiar to all homebuilders or homeowners.

3 **U.S. 65, U.S. 18.**—Mason City in north-central Iowa is an important center of cement manufacture using limestone mined in the area (map location 3). Inquire locally about these limestone quarries and the cement plant locations. Clay pits west of Mason City also provide some of the raw material for cement manufacture.

View of the Cardiff Gypsum Co. quarry in Iowa.



U.S. 20.—Crossing Iowa from Dubuque to Sioux City, U.S. 20 leads through a famous mining center at Fort Dodge. Here in the southeast outskirts of the city, travelers can see one of the largest gypsum mining complexes in the United States (map location 4). Much of central, south-central, and southeastern Iowa is underlain by gypsum deposits. In the Fort Dodge area, five companies mine gypsum and process it into gypsum products, making Iowa one of the principal gypsum-producing States. To get a closer view of the large open pits and quarries and the plants manufacturing plaster and gypsum board, it is necessary to turn off onto city and county streets and roads. Inquire locally for directions. Several clay pits can also be seen in the southern edge of the town (map location 5).

4

5

Iowa 14.—Much of south-central and southwest Iowa is underlain by coal seams, and coal mining has a long and interesting history in the State (map location 6). Few people realize that coal mining was a greater industry in Iowa than farming a century ago.

6

Iowa 163, U.S. 34, U.S. 63, and Interstate 35.—In the area southeast of Des Moines bounded roughly by the towns of Oskaloosa, Ottumwa, Osceola, and Des Moines, can be seen a famous coal mining district. The area is traversed by several State highways (Iowa 92, 5, 14, 137), and several active coal mines and many abandoned coal mines can be seen from these highways. Ask for directions locally.

Iowa 92.—On Iowa 92, about 4 miles west of Oskaloosa, can be seen one of the Iowa State Government's efforts to reclaim abandoned or "orphaned" coal strip mined land (map location 7). The Hull mine site reclamation project was initiated, funded, and conducted by the State of Iowa to demonstrate that strip mined land can be successfully returned to usefulness. Literature on the project can be obtained from the Department of Soil Conservation in Des Moines; a plaque at the mine site tells the story and results of the project.

7

GHOST TOWNS AND HISTORICAL SITES

Iowa has a long, varied, and rich history in which mining is significant in many ways; Iowa has authentic ghost mining towns as romantic and haunting as any in the West.

U.S. 20, U.S. 52.—Dubuque is one of the oldest cities in Iowa. Dubuque was named after Julien Dubuque, a French Canadian fur trader, explorer, and miner who was the first white man to settle permanently in the Iowa area. As early as 1788, the Fox Indians permitted him to work rich lead mines in the bluffs behind the city that now bears his name. (map location 8). He

8

obtained permission from the Indians to work a mine near "Kettle Chief's" village located just south of the present city limits. He studied and learned the language of the tribe and adapted himself to its way of living. His wealth and holdings increased but doubt arose about the validity of his contract of 1788 with the Fox Indians because this entire territory was then the property of Spain. To conciliate the Spanish authorities, he named his lands "The Mines of Spain" and obtained a formal recognition from the Spanish government of Louisiana. He was held in great respect by the Indians, and when he died in 1810, he was buried with honors befitting a chief.

After Dubuque's death, the title to his land was questioned, and in 1854, the Supreme Court of the United States decided that Dubuque had been granted, not the land itself, but merely the right to use it. However, after 1810, the Fox tribe would allow no white man to mine lead. In 1830, an attempt was made to claim possession of the Dubuque area. A meeting was held, and what was perhaps the first, formal set of laws within the present State of Iowa were drawn up. But in July 1830, the United States Government forced the miners to return to the east side of the river since establishment of this settlement was a direct violation of an agreement with the Indians.

With the conclusion of the Black Hawk War in 1832, the settlers again crossed to the Dubuque mines but were again expelled. In June 1833, under the terms of the Black Hawk Treaty, settlement was allowed.

9 The Old Shot Tower, north of East Fourth Street near the river, standing like a lonely sentinel, is one of Dubuque's outstanding landmarks (map location 9). It was erected in 1855 and was used for molding lead shot. The lead was melted and dropped through a screen at the top of the tower, thus forming small balls that cooled and solidified as they dropped into the water at the base. A plaque tells the story of this relic of a romantic era in the history of American mining. The first settlers were attracted here because of lead mines, and mining was the major industry; shipments of hundreds of tons of lead annually were brought to St. Louis. However, the rich and fertile prairie lands soon brought an influx of settlers and agriculture and the development of farms took its place in the pattern of midwestern life.

Historic Coal Mining Area.—An area as prosperous and promising as the south-central Iowa coal mining district can't be described as a ghost area, but certainly it is historic and it does have a few ghost towns.

By 1870, many major railroads had reached the Missouri River. The demand for locomotive fuel con-

The Hull mine site, an abandoned coal strip mine, was selected as a research mine land reclamation project by the State of Iowa.

tinued to rise rapidly. Coal had been seen in Polk County, exposed along the river banks as early as 1840. But the little that was used before 1865 was gathered in wheelbarrows and hauled in wagons. In 1864, Mr. Wesley Redhead and his associates organized the Des Moines Coal Co. and opened up a slope north of Des Moines. By 1917, coal production in Iowa had reached 9 million tons per year.

Lewis of Lucas.—On February 12, 1880, as the coal boom was beginning in south-central Iowa to meet the rising demands for fuel for the railroads, there was born in the village of Lucas (U.S. 34), John Llewellyn Lewis (map location 10). When John was 2 years old, his father organized his fellow coal mine workers in the area and led them in a long and bitter strike against their employers. At 17, John went to work for the Big Hill Coal Co. at Lucas. His later career, dedicated to the cause of the coal miner, is of national interest rather than local history, but John L. Lewis grew, developed, toughened, and found direction in the coalfields of southern Iowa.

10

Buxton.—Officially a ghost town, Buxton is south of Oskaloosa on Iowa 137 and 5 but is not indicated on present-day maps. Ask locally for exact spot. Today, Buxton is only the remnants of old foundations and a couple of buildings crumbling with age, marking the spot where a once bustling community of 9,000 people lived (map location 6). Buxton had its beginnings over a century ago with the opening of one of the earliest and largest coal mines in Iowa. The now famous Consolidation Coal Co. had its origin in Buxton.

6

From 1880 for more than 40 years, Buxton was extremely prosperous, culturally advanced, and at one time, was called the toughest town east of Dodge City. The coal gave out in the 1920's and Buxton officially died when mine No. 18 was leveled by dynamite in 1944. Buxton is now a ghost mining town with as fascinating a history as any ghost town in the West.

Ottumwa Coal Palace.—A unique but long since vanished splendor and a landmark in the history of Iowa coal mining industry was established in 1890 with the building of the Coal Palace at Ottumwa at the intersection of U.S. 63, U.S. 34, and Iowa 23 (map location 11). The Coal Palace was a joint project in which a dozen or more coal-producing counties took part. It was the brainchild of Peter Ballingall, who organized a group to raise money for an exposition building that was to publicize the coal resources of the State in a way similar to that in which the famous Corn Palace of Sioux City was advertising its agriculture.

11

The most amazing fact about the Coal Palace was that with its 800,000 feet of lumber and vast amount of other material and its 5,000 man-days of labor, its cost was less than $30,000. It was a massive and impressive pile, veneered with blocks of coal. The Coal Palace was 230 feet long and 130 feet wide, surmounted by a central tower 200 feet high supported

The Iowa Coal Project, a program combining strip mining methods, coal treatment, and land reclamation, was conducted with funds appropriated by the State of Iowa.

Barge tows travel the Mississippi River carrying agricultural and manufactured products and a huge tonnage and variety of mineral products.

by four massive, rectangular pillars 10 feet square so fashioned as to resemble solid columns of coal. The building enclosed huge display rooms for exhibits and an auditorium seating 6,000 persons.

Thousands of persons came from all over the country to the exposition held in this great building—politicians, senators, governors, and world-famous personages. The crowning event was the visit of President Benjamin Harrison, who combined his public appearance with a family reunion with his brother from Kansas City and his sister from Ottumwa. Governor Boies, in his address on the opening day, spoke of the magnificent dowry of Iowa, of the riches to be won from the earth, of vast sums paid out in wages to the miners, and of great additions to the economy. President Harrison referred to the Coal Palace as "an illustration of how much that is artistic and graceful is to be found in the common things of life."

After 2 years, the Coal Palace was razed, and now only its site, Ballingall Park, commemorates the event.

4 **Cardiff Giant—A Gypsum Joke.**—A 5-ton block of gypsum 12 feet long from a mine southeast of Fort Dodge (map location 4), was purchased just over a century ago, loaded on a wagon drawn by six teams of oxen, and driven on a 3-week trip to the nearest railhead at Boone, Iowa. From Boone, the block went to Chicago where an artist and a stonecutter produced a 10-foot "giant." This 3,000-pound giant was then taken by rail to a farm near the hamlet of Cardiff in the Onondaga Valley south of Syracuse, N.Y., and buried in the ground, where it was discovered a year later by water well diggers and the "Cardiff Giant" became perhaps the most colossal hoax of all time. A true story, a funny story . . . a fake, petrified man that fooled millions, but made a rich man of the practical joker—George Hull—a genius at evoking the gullible in man. A replica of this fraud can be seen at the Fort Dodge Historical Museum (U.S. 20 and 169).

12 **Bertrand.**—On its way up the Missouri River with a load of supplies for the miners in Montana, the sternwheeler riverboat Bertrand was sunk in 1865 near what now is called Desoto Bend on the river southwest of the intersection of Interstate 29 and U.S. 30 north of Council Bluffs (map location 12). The Bertrand was discovered in 1969 and parts of this relic, resurrected from a muddy grave, are now on public display—of particular interest for those considering the significance of mining to the settlement and development of the West.

FOR MORE INFORMATION WRITE OR VISIT

Fort Dodge Historical Foundation, Inc., Museum Road and Highway 20, P.O. Box 1251, Fort Dodge, Iowa 50501.

Iowa Geological Survey, Campus of the University of Iowa, Iowa City, Iowa 52240.

Iowa Limestone Producers Association, 106 Gladstone Building, Des Moines, Iowa 50309.

Tourism and Travel Division, Iowa Development Commission, 250 Jewett Building, Des Moines, Iowa 50309.

SELECTED REFERENCES

Coal Mining in Iowa, by H. L. Olin. State Mining Board, Iowa Department of Mines and Minerals, Des Moines, Iowa, 1965, 95 pp.

Historic Iowa. Map, Tourism and Travel Division, Iowa Development Commission, Des Moines, Iowa.

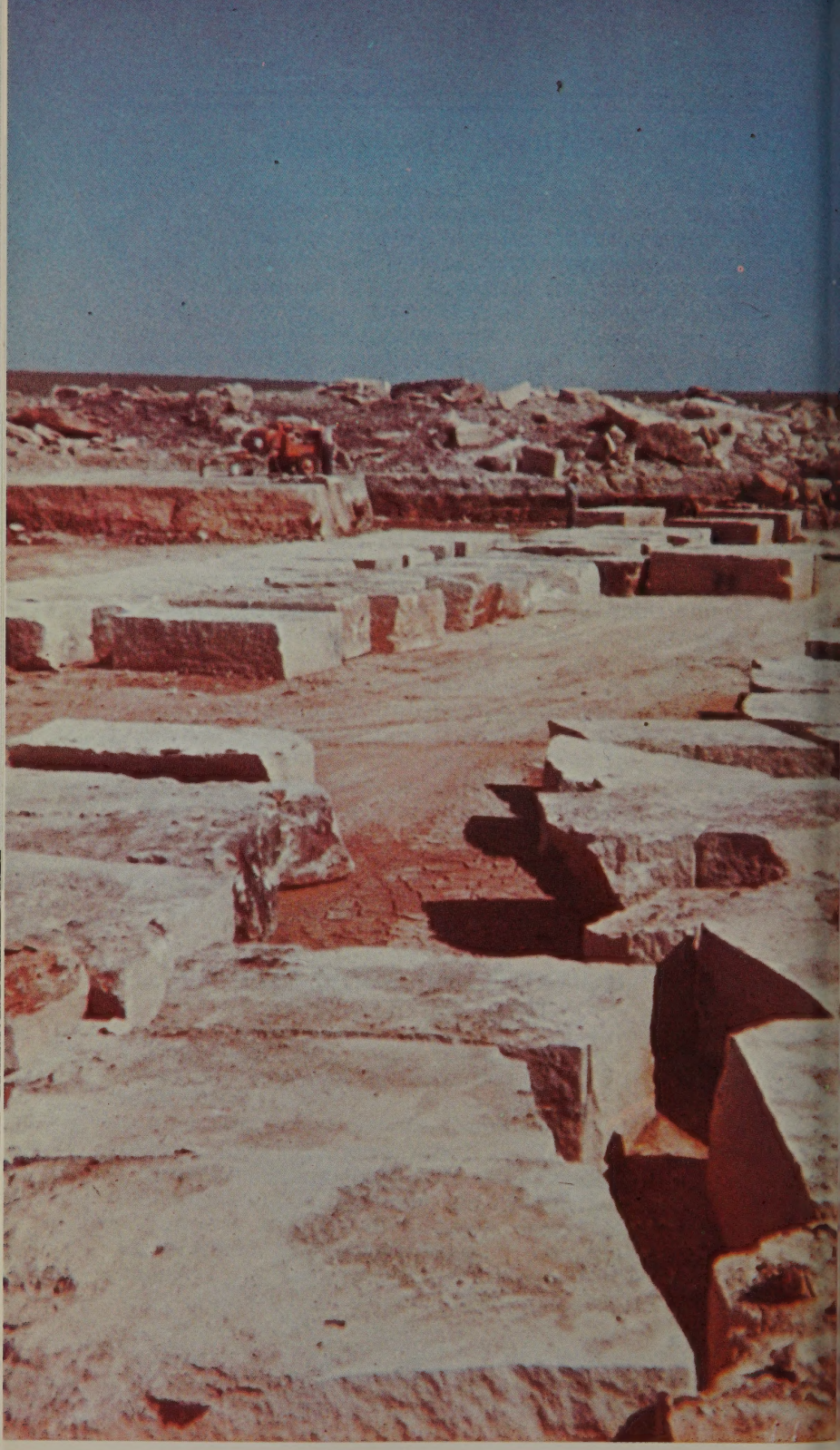
The History of Early Fort Dodge and Webster County, Iowa, by W. Williams, ed. by E. Breen. Radio Station KVFD-KFMY, Fort Dodge, Iowa, 1962, 110 pp.

Iowa—A Place To Grow. Tourism and Travel Division, Iowa Development Commission, Des Moines, Iowa, 40 pp.

Limestone—Iowa's Buried Treasure. Iowa Limestone Producers Association, Des Moines, Iowa, 26 pp.

The Original Cardiff Giant, by A. Hynd. True—The Man's Magazine, 1951, 14 pp.

Report of the State Mine Inspector, Biennial Period Ending December 31, 1971, by W. D. Aubrey. 1972, 53 pp.



Born quarry of Silverdale Stone in Cowley County, Kans. (Courtesy of Kansas Geological Survey.)

KANSAS

by
Harry F. Robertson

Kansas is known primarily for its output of crude oil, natural gas, and helium. The Hugoton gasfield in southwestern Kansas on U.S. 56 is the world's largest (map location 1). The mines producing coal, salt, and building materials produce less in monetary value but are equally as interesting. 1

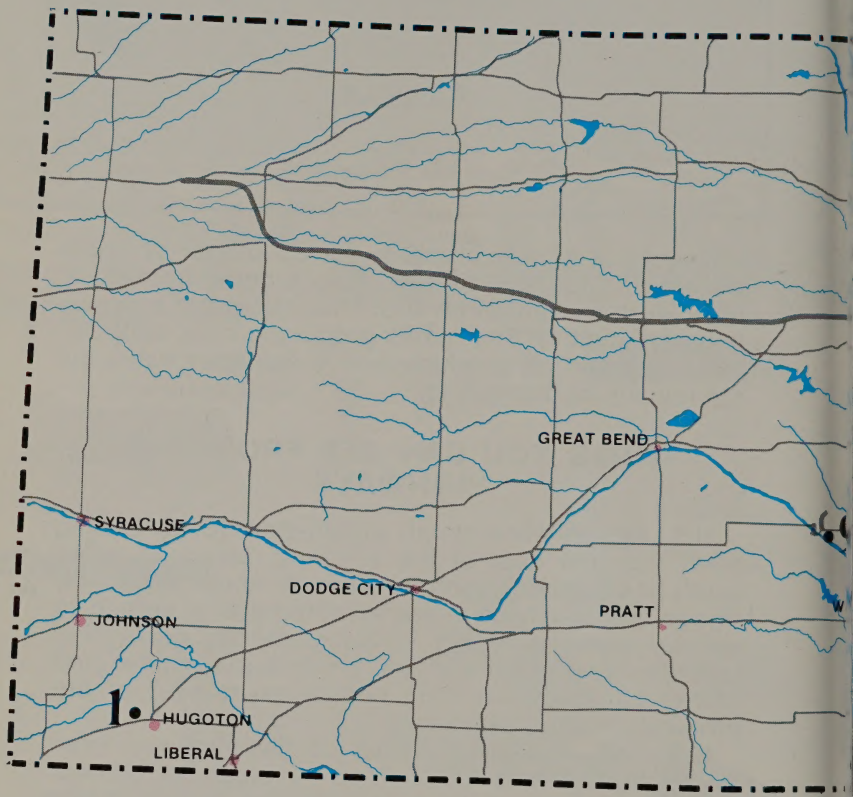
MINES YOU CAN SEE FROM THE HIGHWAYS

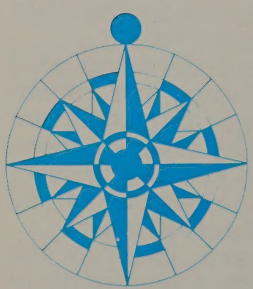
U.S. 69.—A mine-mouth steam-electric generating plant lies just east of the highway, about 21 miles south of Louisburg (map location 2). About 4,000 tons of coal per day from a nearby strip mine is burned to convert water to steam in the electricity generating process. The mine and its enormous dragline and shovel can be seen from county roads east of the powerplant (map location 3). 2 3

U.S. 166.—About 20 miles of this highway from Baxter Springs west of Chetopa traverses the famous Tri-State mining district, the district was a major zinc-lead producer for many years but is currently inactive (map location 4). Mountainous chat piles (local term for the waste rock produced during the zinc mining and milling) can be seen in all directions. The many abandoned mines in the area are fertile areas for rockhounds. Use extreme caution; the open shafts at these mines rarely have guard rails. 4

U.S. 69.—The southeast Kansas coal-mining area begins about 10 miles north of Pittsburg and continues south. Currently, only two major producers are strip mining the shallow coal deposits (map locations 5–6). Reclamation of the mined land has become very important in the area, and numerous examples can be seen from county roads in the vicinity of Pittsburg. 5 6

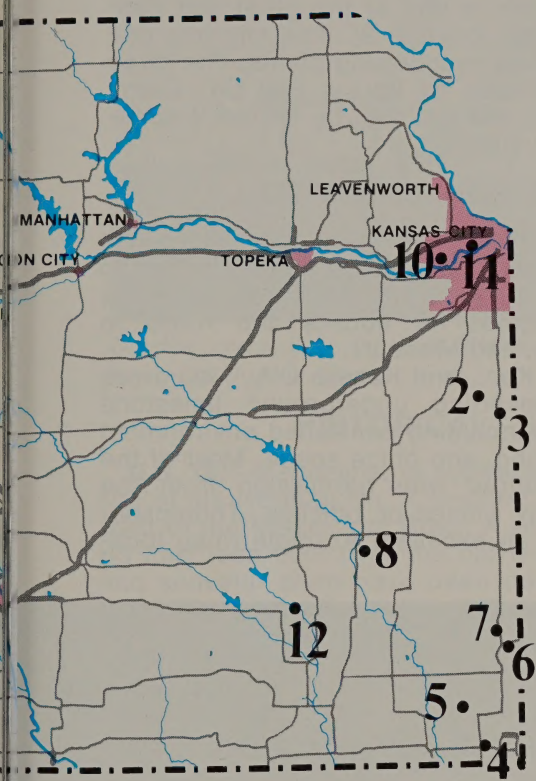
Crawford County State Park and Lake at the intersection of U.S. 69 and U.S. 160, a mile north of Pittsburg, was constructed from an old strip-mined area. Camping, picnicking, and fishing facilities are available in the park (map location 7). 7





LEGEND

1— Hugoton gasfield
2— Steam-electric generating plant
3— Large opencut coal mine
4— Tri-State lead-zinc mining district
5— Coal strip mine
6— Coal strip mine



7— Reclaimed strip mine area
8— Cement plant
9— Salt mine and processing plant
10— Sand and gravel pits
11— Underground storage areas
12— Historic oil well

U.S. 169.—The Monarch Cement Co. plant at Humboldt is one of the most modern cement plants in the world. The operation may be observed from the highway, which passes between the quarries and the plant (map location 8).

8

U.S. 50.—Hutchinson is one of the great salt centers of the world (map location 9). The city has one salt mine and three salt evaporating plants. The three evaporating plants owned by Barton Salt Co., Carey Salt Co., and Morton Salt Co. may be toured if application is made in advance.

9

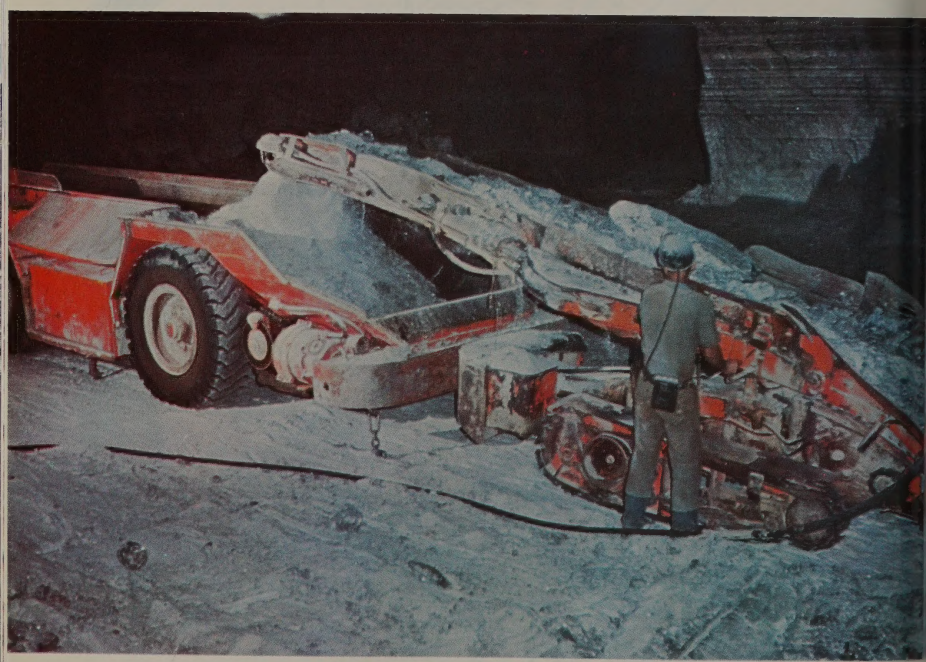
MINES YOU CAN VISIT

Kan. 32.—Several sand and gravel operations can be seen from the road going from Bonner Springs to Kansas City. (map location 10). These produce the all-important aggregates for houses and roads in Kansas City, Kansas, and Missouri.

10

The Kansas City, Kan., and Kansas City, Mo., areas are leaders in converting underground limestone mines to other uses including controlled environment storage, manufacturing, and office space. Most of the facilities can be toured with permission from the appropriate company offices or officials. Thompson-Strauss Quarries is an excellent example (map location 11).

11



Salt being loaded on a shuttle car at the Carey Salt Co. mine, Hutchinson, Kans. (Courtesy of Kansas Geological Survey.)

Dragline operated by Pittsburg-Midway Mining Co. at a coal strip mine in Linn County, Kans.

HISTORICAL SITE

U.S. 75.—Neodesha, in southeastern Kansas, is the site of the Norman No. 1, the first commercial oil well west of the Mississippi River. A replica of the original rig has been built over the old well, and a park area and souvenir shop have been developed (map location 12).

12

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, 518 Capitol Federal Building, Topeka, Kans. 66603.

Kansas Geological Survey, Mineral Resources Section, University of Kansas, Lawrence, Kans. 66044.

SELECTED REFERENCES

The Geologic History of Kansas, by D. F. Merriam. Kansas Geological Survey, Bulletin 162, 1963, 317 pp.

Geological Highway Map of the Mid-Continent. American Association of Petroleum Geologists, U.S. Geological Highway Map Series, Map 1.

Inventory of Industrial, Metallic, and Solid-Fuel Minerals in Kansas, by R. G. Hardy. Kansas Geological Survey, Bulletin 109, part 5, 1970, 30 pp.

Kansas Mineral Industry Report (1971), by L. L. Brady and others. Kansas Geological Survey, Special Distribution Publication 61, 1972, 108 pp.

Towns and Minerals in Southeastern Kansas. A Study in Regional Industrialization, 1890–1930, by J. G. Clark. Kansas Geological Survey, Bulletin 162, 1963, 317 pp.

Restoration of Fayette, a furnace town where ore was converted to pig iron before shipment.

MICHIGAN

by
Edward C. Peterson and Esther A. Middlewood

Michigan Indians were among the first metalworkers in history; they fashioned their weapons from Lake Superior copper to hunt mastodons. Michigan copper was unmistakably present in Mexico to interest Cortez, and later, it was a factor in the French exploration of the Lake Superior region. But it was not until 1843, after a young physician named Douglass Houghton, who was interested in geology, found copper and evidence that it had been deposited in commercial quantities, that a mining boom of unprecedented proportion was born. Today, although mining remains the major industry in Michigan's Upper Peninsula, the boom is long past. The area is spotted with ghost towns and abandoned mine workings that offer fascinating subjects for the history-minded tourist or student to explore. For the rockhounds, many specimens of native copper, iron, and semiprecious stone are available to those who search these relics of the past.

MINES YOU CAN SEE FROM THE HIGHWAY

U.S. 41.—Between Houghton and Calumet in northwestern Michigan, the highway, which is also Mich. 28 in this area, passes through the heart of the State's copper country (map location 1). More than 10 billion pounds of native copper have been taken from underground mines in the area. Native copper was mined here by ancient man, and mining has continued to the present day. Hundreds of mines have been opened and closed in the area since the 1840's, and signs along the highway note some of the locations. The most famous mines of the district were the Quincy (see "Ghost Towns and Historical Sites"), Centennial (to be reopened by Homestake Copper Co.), Calumet Conglomerate, and Ahmeek. Many old ore dumps are accessible to the public. 1

Numerous underground iron mine sites on the Marquette iron range near Ishpeming-Negaunee can be viewed from the roads (map location 2). Famous mines in the area include the Empire, Mather, Cliffs Shaft, and Jackson. The Marquette range ore docks are located at Marquette, 10 miles east of Negaunee. The Marquette iron range was the site of the first iron mines of the Lake Superior district. A roadside marker in the park at Negaunee is a useful point of reference for locating other historical sites in the area.

2

Mich. 64.—At White Pine in Ontonagon County, the White Pine mine can be viewed from the road (map location 3). It is the second largest underground copper mine in the United States, producing about 130 million pounds of copper each year. It is also the only copper mine currently producing in Michigan.

3

U.S. 25.—At Sanders and West Fort Street in Detroit is the salt mine of International Salt Co. (map location 4). The openings of this famous underground mine lie about 1,150 feet beneath the streets of the City of Detroit. The salt beds are mined by room-and-pillar methods.

4

U.S. 23.—Just west of U.S. 23 at Alabaster, gypsum quarries, originally discovered in 1837 by Indian traders, were extensively mined beginning in 1862. (map location 5). Operations and loading with the unusual marine tramline can be viewed from an overlook just west of the highway.

5

Mich. 26.—Between Phoenix and Eagle Harbor in Michigan's Upper Peninsula, the highway runs near another copper district. The Arnold mine, typical of many abandoned copper mine sites, is located a short distance south of Copper Falls (map location 6). The Arnold operated during the period 1899–1911 and produced some 2 million pounds of fine copper. When the mining firm decided further operations were hopeless, they disposed of the property (1926). The flooding of Jacob's Creek in 1971 revealed the workings of the mine and rock dump piles long hidden from view.

6

MINES YOU CAN VISIT

U.S. 27.—When the Mt. Pleasant oilfield opened in 1928, Michigan became one of the leading producers in the Eastern United States. Well depths range from 1,000 to 6,000 feet. The Alma Chamber of Commerce will arrange tours of several refineries in the Alma area (map location 7). A roadside marker at the rest area on U.S. 27, south of Mount Pleasant, includes historical data and a map showing principal oilfields (map location 8).

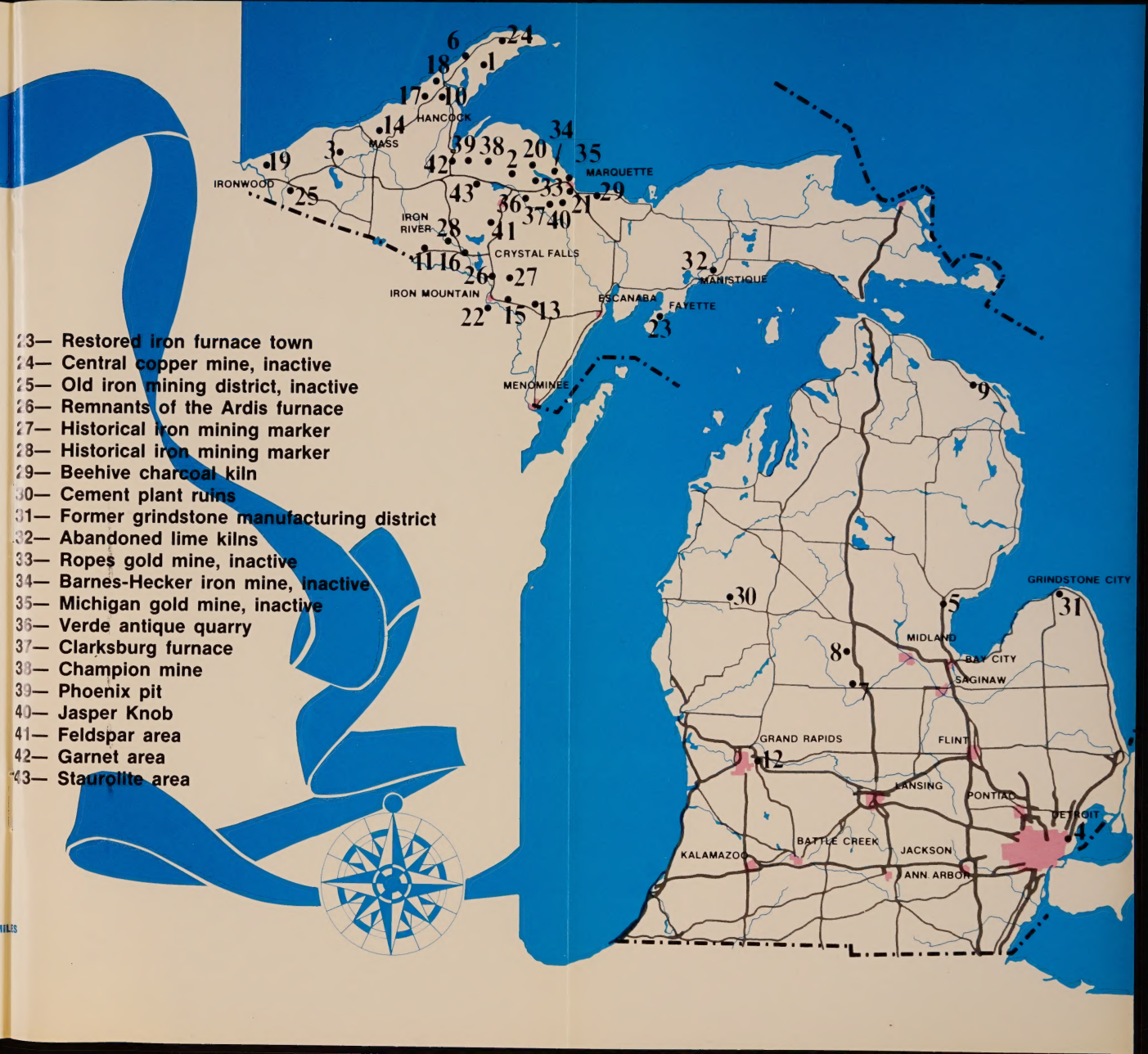
7

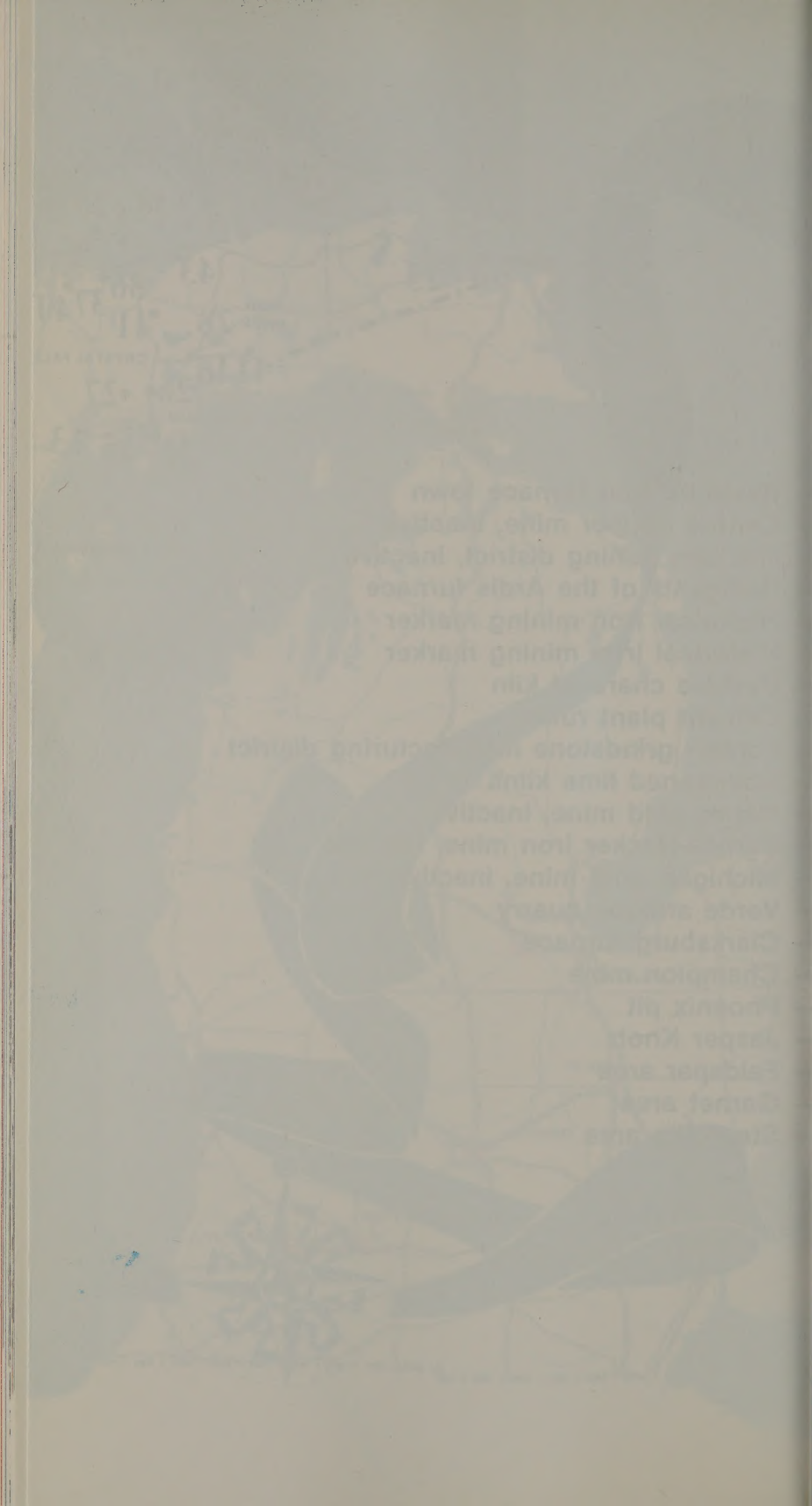
8

U.S. 23 (business route), Mich. 68.—The quarrying operations seen at Calcite (Rogers City) are the larg-

LEGEND

1— Copper mining district, inactive
2— Marquette iron range
3— White Pine copper mine
4— Salt mine
5— Alabaster gypsum quarry
6— Copper mining district, inactive
7— Mt. Pleasant oilfield
8— Roadside oilfield marker
9— Limestone quarries
10— A.E. Seaman Mineralogical Museum
11— Iron County Historical Museum
12— Gypsum mine, inactive
13— Copper mine, inactive
14— Adventure copper mine, inactive
15— Iron Mountain iron mine, inactive
16— Crystal Falls iron mine, inactive
17— Quincy copper mine, inactive
18— Menominee iron range marker
19— Gogebic iron range marker
20— Historical iron ore discovery marker
21— Jackson Forge-proposed restoration project
22— Chapin pit cave area


23— Restored iron furnace town
24— Central copper mine, inactive
25— Old iron mining district, inactive
26— Remnants of the Ardis furnace
27— Historical iron mining marker
28— Historical iron mining marker
29— Beehive charcoal kiln
30— Cement plant ruins
31— Former grindstone manufacturing district
32— Abandoned lime kilns
33— Ropes gold mine, inactive
34— Barnes-Hecker iron mine, inactive
35— Michigan gold mine, inactive
36— Verde antique quarry
37— Clarksburg furnace
38— Champion mine
39— Phoenix pit
40— Jasper Knob
41— Feldspar area
42— Garnet area
43— Staurolite area
HANCOCK
MASS
IRONWOOD
IRON RIVER
CRYSTAL FALLS
IRON MOUNTAIN
MENOMINEE
MARQUETTE
MANISTIQUE
ESCANABA
FAYETTE
GRINDSTONE CITY
MIDLAND
BAY CITY
SAGINAW
GRAND RAPIDS
FLINT
LANSING
PONTIAC
DETROIT
BATTLE CREEK
JACKSON
KALAMAZOO
ANN ARBOR



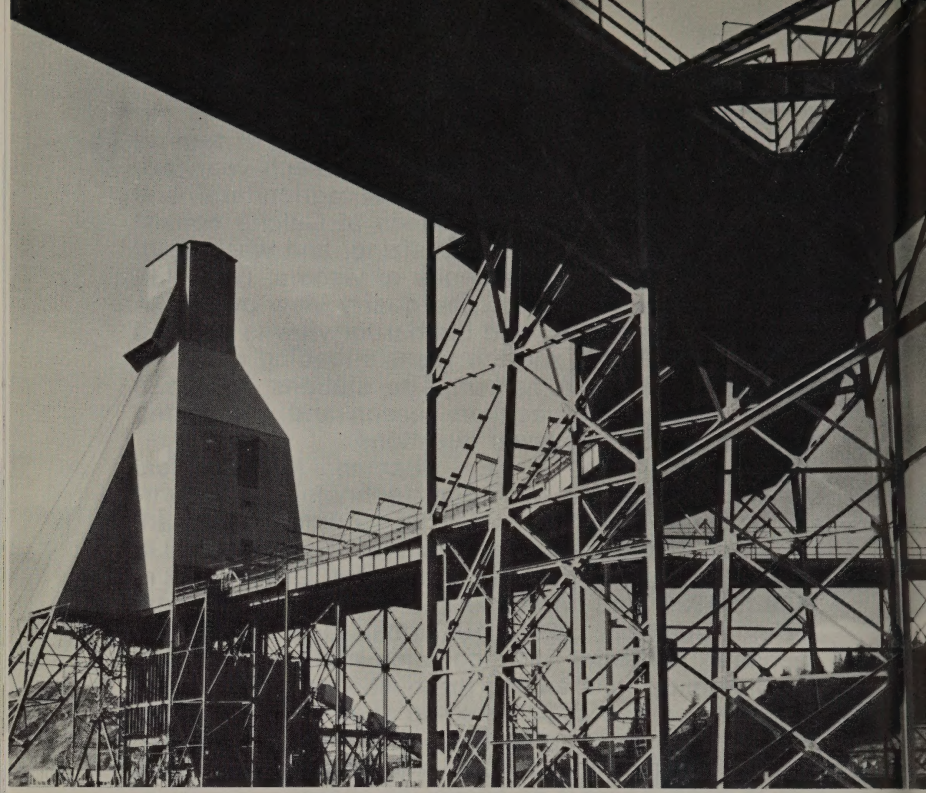
est in the world (map location 9). Millions of tons of limestone are shipped from this plant each year, primarily for use in the steel, chemical, agricultural, and cement industries. The operations at Calcite consist chiefly of quarrying, crushing, sizing, and washing of limestone. For the convenience of visitors, two lookout stations are provided. The quarry view overlooks the quarry operations, and the harbor view is situated so that visitors can see the vessels loading or entering and leaving the harbor. The stations are open during the summer vacation season and are staffed by guides who can answer questions. 9

Mich. 26.—The A. E. Seaman Mineralogical Museum, located at Michigan Technological University, is named in honor of Arthur Edmund Seaman, professor of mineralogy at Michigan Tech from 1893 to 1928; head of the Department of Geology from 1899 to 1928; and curator of the museum and professor emeritus from 1928 to 1937 (map location 10). The specimen collection now contains more than 30,000 samples and ranks among the best in the country for its beauty as well as its teaching and reference value. The museum is open to the public Monday through Friday, 9:00 a.m. to 4:30 p.m. and on Saturdays, 9:00 a.m. to noon. There is no admission charge. 10

The original Arcadian mine was established in 1864. Millions of dollars were spend on the original vertical shaft development in 1900. In 1939, an Italian immigrant named Paoli promoted the reopening of the project by less costly horizontal tunneling. Recurring finds encouraged the developers. However, with Paoli's death in 1943, the incentive was lost. The horizontal copper mine is no longer operational—it is open for tourists only (map location 13). The mine, located at Ripley, is open July and August from 8:00 a.m. to 5:30 p.m. daily; in June and September to mid-October, it is open from 8:00 a.m. to 4:30 p.m. There is an admission charge. 13

U.S. 2.—In its efforts to stimulate an interest in the history of Iron County and its adjoining areas, the Iron County Historical and Museum Society has developed a museum on 5½ acres of land at Iron River (map location 11). The building was originally the hoist and compressor house of the Caspian mine, owned by Pickands Mather and Co. The shaft house is still standing and forms a background for the museum area. The museum includes an outside mining display and an indoor museum. Inside, the new section of the museum is a glass display containing mineral specimens and artifacts. There is also a working model of the former Homer-Wauseca mine. 11

The Iron Mountain iron mine was owned by the Penn Iron Mining Co., operators of extensive mining works in the Vulcan-Norway vicinity (map location



View of an iron mine in the State of Michigan.

15). Guides show visitors through 2,600 feet of underground drifts and tunnels 400 feet below the surface. The mine provides student project information and free iron ore samples. It is open daily from 8:00 a.m. to 6 p.m. and charges an admission fee.

From 1882 until it closed in 1907, the Crystal Falls iron mine was known as the Kimball (map location 16). It was pumped out in 1960 to become one of the few private deep shaft iron mines in the country open to the public. Admission is charged.

U.S. 131.—Gypsum was used in the manufacture of plaster and was mined at the Alabaster mine starting in 1907 (map location 12). A $1 million plant was established at this time, employing hundreds underground, and was in operation until 1943, when mining operations were discontinued. There is no actual mining in process now at the mine—the only business is the natural storage of perishable foodstuffs in the old tunnels and tour trips through the mine. It is a rare opportunity for rock hunters to poke around an old mine that in many areas is just as it was left when mining operations ceased over 20 years ago. Daily tours are available (by appointment only) Monday through Saturday from 8:30 a.m. to 6 p.m. There is a small admission charge. Contact Michigan Natural Storage, 1200 Jude Avenue, S.W., Grand Rapids, for further information.

U.S. 45.—The Old Adventure copper mine is located at the base of the Keewenaw Peninsula in Ontonagon County (map location 14). During its productive years, the mine produced thousands of tons of copper and thousands of ounces of silver but never paid a dividend to its stockholders. The mine has been developed into a tourist attraction with underground tours complete with hard hat and miner's light. The mine officially opened for tours in July 1973. It is open daily from 10 a.m. to 5 p.m. and charges admission. 14

GHOST TOWNS AND HISTORICAL SITES

Mich. 26.—The Quincy Copper Mining Co. opened the Pewabic copper lode in 1856 (map location 17). This mammoth hoist at the Quincy No. 2 shaft was completed in 1920 and installed late that same year. It operated from 1920 until the 1930's, hoisting copper ore from a depth of 9,260 feet on the incline, a depth of 6,310 feet vertically. All mining operations ceased in 1945. Not only is this giant hoist itself of great interest, but the lore of the Quincy Mining Co. is an important part of the copper country. An admission fee to the permanent exhibit at Hancock is charged. 17

U.S. 2.—The roadside marker at the park on U.S. 2 near Wuinnessee is dedicated to the Menominee iron range. The marker contains historical information relating to the development of iron deposits in this area. It includes a map of the Menominee iron range (map location 18). 18

The historical marker located along U.S. 2 1 mile east of Bessemer is dedicated to the Gogebic iron range. It contains historical information relating to the development of the iron deposits in this area and includes a map of the Gogebic iron range (map location 19). 19

The Chapin pit, long a landmark in Iron Mountain and a reminder of the colorful mining era, offers the visitor an opportunity to traverse one of the greatest underground mining operations in the Upper Peninsula (map location 22). This has become one of the world's most outstanding cave-ins. Waters, flooding a portion of the pit, necessitated installation of the huge Cornish pump, located on the surface near the main shaft, just west of the cave-in area. The Cornish pump was the largest of its type ever built in the United States. The pump is of the type used originally at tin mines in Cornwall, England, from which its name was derived. 22

The furnace town of Fayette, 17 miles south of U.S. 2 in Fayette State Park, was conceived over a century ago by Fayette Brown, manager of Negaunee's Jackson Iron Co., as a solution to the great cost of ship-

ping raw iron ore to the lower lakes (map location 23). Here at Fayette the ore was converted to pig iron before shipment. Cleveland Cliffs acquired the Jackson Iron Co.'s holdings in 1905. The state purchased the town in 1950 from Frank D'Hooge, and restoration began in 1967–68. Since Fayette became a State Park in 1959, repair, preservation, and restoration work has been continuous. Fayette is Michigan's only restored ghost town.

Wakefield, a typical iron mining community at the eastern end of the Gogebic range open mine pits, includes several historic buildings of early mining decades (map location 25).

A series of odd-shaped concrete blocks are all that are left of the Ardis furnace built in 1908 by John Tyler Jones to use low-grade ore (map location 26). The first of its kind, the furnace heated the ore and sent it down a rotating tube into contact with carbon monoxide gases, which reacted to remove the iron oxides. The venture failed because the firebricks lining the furnace could not withstand the heat produced by the chemical reaction during long continuous operation. A large plaque marks the historic spot where the furnace once stood.

At Keel Ridge, approximately one-fourth mile east of Iron Mountain city limits, there are some signs of mining activity still visible, but the mine is generally associated with a mine disaster on April 10, 1883. On that date, a cave-in occurred burying eight miners. A marker was placed at the site in memory of the miners (map location 27).

Lime kilns can be seen 2 miles east of Manistique, near Cherry Valley, which was founded in 1910 but is now abandoned (map location 32).

U.S. 41.—A historical marker at the Jackson mine near Negaunee indicates the spot in 1844 where iron ore was first discovered in Michigan (map location 20). As a result of this discovery, the Jackson Mining Co. began taking out ore in 1847. Thus was born the Lake Superior area's great iron mining industry.

Efforts are being made to develop the Carp River forge area (map location 21). The restoration will be used as the major attraction of an iron ore interpretive center for the Marquette iron range, oldest operative range in the Lake Superior district. The project is expected to be an authentic operating restoration of the original Jackson Forge on the Carp River, with supporting exhibits of iron ore mining on the Marquette range. Exhibits will cover the period of time from 1844 to 1872.

The Central mine, north of Phoenix, operated from 1854 until the ore ran out in 1898 (map location 24). Many of the buildings are still standing in the abandoned village. A wood sign along U.S. 41 tells the

story. Foundations and remains of mining operations are still visible at the end of what was once the main street. Annual reunions of former residents are held at the old church, built in the late 1880's. The houses are owned by the Calumet & Hecla Mining Co.

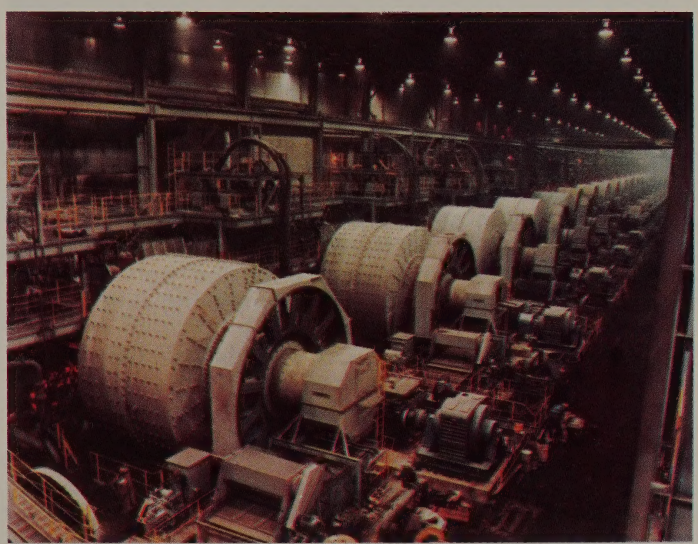
The charcoal kiln near Marquette State Prison is the only one remaining of a group that once processed charcoal for use in the iron smelting furnaces in the Marquette region (map location 29). It is built of stone in the traditional beehive shape. **29**

The Ropes gold mine, 4 miles from Deer Lake, north of Ishpeming, operated from 1883 to 1897 (map location 33). It is now considered a must by rockhounds searching for mineral samples. **33**

The Barnes-Hecker iron mine, 9 miles from Ropes gold mine, was the site of a cave-in disaster in 1926 when 52 men were trapped 1,000 feet below the surface (map location 34). The bodies were never recovered and the shaft was sealed. **34**

The Michigan gold mine, about 1½ miles from the Barnes-Hecker mine, was discovered in 1888 (map location 35). The mine was closed and an attempt to reopen it was abandoned in 1937. **35**

Mich. 69.—A rough wood plaque has been erected at the Mansfield mine, 7 miles east of Crystal Falls, in memory of the cave-in that killed 27 miners (map location 28). On September 28, 1893, the Michigamme River overflowed its banks and flooded the mine, causing the cave-in. The mine was sealed off and never reopened. **28**



Tumbling inside these autogenous mills at the Empire mine, crude iron ore crushes itself. (Courtesy of Cleveland-Cliffs Iron Co.)

The abandoned shaft at Quincy No. 2 copper mine.

30 **Mich. 37.**—In 1901, the Great Northern Portland Cement Co. was incorporated to manufacture cement from the marl found in the Marlborough area, 2 miles south of Baldwin off Mich. 37 (map location 30). The process proved too costly, and the plant closed down in 1908. The 400 employees departed and Marlborough became a ghost town. The imposing ruins of the $1 million cement plant remain.

31 **U.S. 25.**—Until about 1930, Grindstone City was a major producer of grindstones and sharpening stones (map location 31). Many grindstones, some 6 feet in diameter, can still be seen along the shore of Lake Huron. The former quarries are also visible.

Isle Royal National Park.—This 45-mile-long island located in Lake Superior about 50 miles northwest of the Keweenaw peninsula is archeologically interesting because of shallow Indian copper mining pits that are 4,500 years old. Using beach cobbles, the Indians hammered out pure copper from the hard bedrock.

From 1843 to 1899, prospecting and copper mining took place on the island. Some ruins are still evident. In 1940 it became a national park. Twenty-four campgrounds and lodge facilities are available in the summer season.

Interest in mineral collecting has been of growing importance to tourists and students. The following, with map locations in parentheses, are areas that hold a particular appeal to rockhounds: Rope gold mine (33), verde antique quarry (36), Clarksburg furnace (37), Champion mine (38), Phoenix pit (39), Jasper Knob (40), feldspar area (41), garnet area (42), and staurolite area (43).

33
36
37
38
39
40
41
42
43

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, Room 1121, Commerce Center Building, 300 South Capitol Avenue, Lansing, Mich. 48933.

Michigan Chamber of Commerce, 501 South Capitol Avenue, Lansing, Mich. 48933.

Michigan Historical Museum, 505 North Washington Avenue, Lansing, Mich. 48933.

Michigan Tourist Council, Michigan Department of Natural Resources, First Floor, Commerce Center Building, 300 South Capitol Avenue, Lansing, Mich. 48933.

State Geologist, Geological Survey Division, Michigan Department of Natural Resources, Fourth Floor, Stevens T. Mason Building, Lansing, Mich. 48926.

SELECTED REFERENCES

Boom Copper (The Story of the First U.S. Mining Boom), by A. Murdoch. MacMillan Co., New York, 1943, 255 pp.

Michigan Copper and Boston Dollars (An Economic History of the Michigan Copper Mining Industry), by W. B. Gates, Jr. Harvard University Press, Cambridge, Mass., 1951, 301 pp.

Michigan Ghost Towns, Vol. I, by R. L. Dodge. Glendon Publishing, Tawas City, Mich., 1970, 120 pp.

Michigan Ghost Towns, Vol. II, by R. L. Dodge. Treasure Hunters Association, Inc., Osoda, Mich., 1971, 191 pp.

Michigan Ghost Towns, Vol. I, by R. L. Dodge. Glendon Publishing, Tawas City, Mich., 1973, 301 pp.

Michigan Historical Markers, ed. by W. F. Dunbar. Michigan Historical Commission, Lansing, Mich., 1967, 218 pp.

Red Metal (The Calumet Hecla Story), by C. Henry Benedict. University of Michigan Press, Ann Arbor, Mich., 1952, 257 pp.

Jones & Laughlin Steel Corp. Lind-Greenway mine near Grand Rapids, Minn.

MINNESOTA

by
Wesley A. Grosh

Iron mining first began in Minnesota in 1884, and since 1901, the State has surpassed all others in iron ore production. The taconite process for concentrating low-grade iron materials was perfected at the State University, and the first commercial taconite processing plant in the world was erected at Silver Bay, Minn., where pellet production began in 1955. Nonmetallic minerals—sand and gravel and stone—are mined in many areas of the State.

MINES YOU CAN SEE FROM THE HIGHWAYS

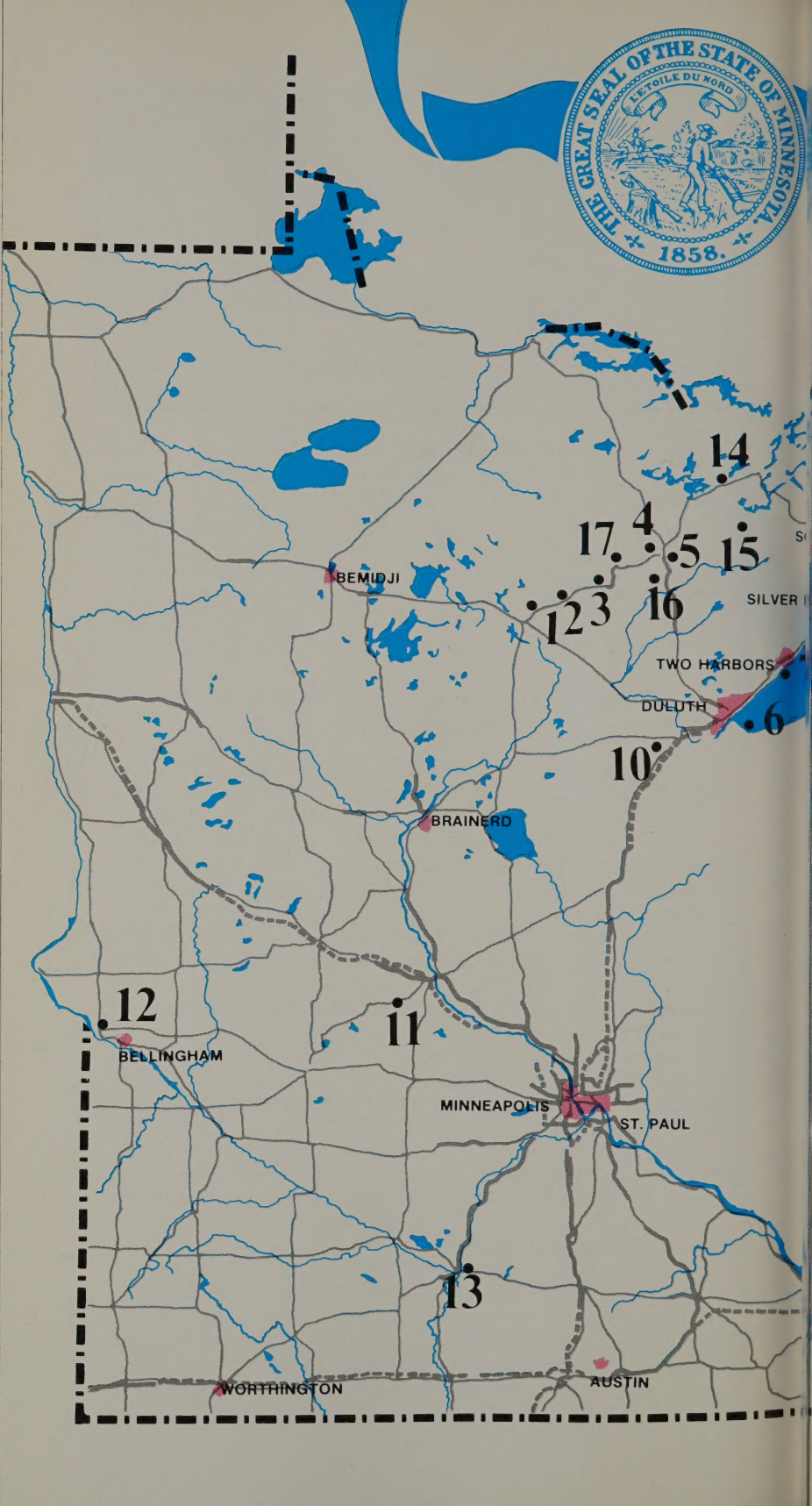
U.S. 169.—From Grand Rapids to Mountain Iron, the highway parallels the famed Mesabi range. There are numerous observation points along the highway where one can observe the large open pits. Marble, Nashwauk, Hibbing, Mountain Iron, and Virginia are some of the towns having vantage points (map locations 1–5).

U.S. 61.—At Duluth, some of the largest iron ore docks in the United States can be seen, and during the summer shipping season, it is seldom that one cannot see a lake iron ore carrier either at a dock or entering or leaving the port (map location 6).

North of Duluth at Two Harbors are additional ore docks as well as a museum near the port area. At the museum is one of the largest steam locomotives formerly used for transporting iron ore to the ports. The steam locomotives have now been replaced with diesel locomotives (map location 7). The museum, operated by the Lake County Historical Society, is open from 9 a.m. to 4 p.m. from late May through September. Admission is free.

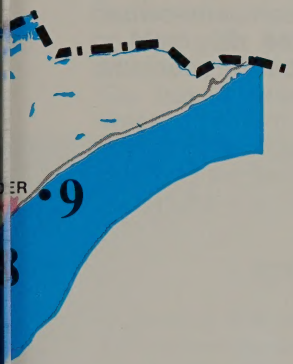
At Silver Bay are the E. W. Davis concentrating plant and docks of Reserve Mining Co. (map location 8). The plant was named for Dr. Davis, who worked for many years to develop and perfect the processes involved in making a high-grade blast furnace feed. The plant concentrates low-grade ore brought to it

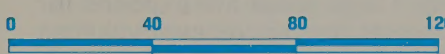
1 2 3 4 5 6 7 8


THE GREAT SEAL OF THE STATE OF MINNESOTA
L'ETOILE DU NORD
1858
BEMIDJI
BRAINERD
DULUTH
TWO HARBORS
SILVER
BELLINGHAM
MINNEAPOLIS
ST. PAUL
WORTHINGTON
AUSTIN
1
2
3
4
5
6
10
11
12
13
14
15
16
17

LEGEND

1-5— Mesabi Range open pit iron ore mines
6— Iron ore docks
7— Iron ore docks and historical museum
8— Taconite benefication plant
9— Taconite stockpiles and loading docks
10— Peat mine
11— Granite quarry
12— Granite quarry
13— Limestone quarry
14— Underground Soudan iron mine, inactive
15— Taconite (iron ore) mine
16— Taconite (iron ore) mine
17— Minnesota Museum of Mining





over a 47-mile company railroad from Babbitt to Silver Bay. The plant has a rated capacity of 10,800,000 tons of pellets per year from the treatment of over 30,000,000 tons of crude ore. An observation platform is maintained where visitors may view the plant and harbor. During the summer months, the company usually has someone to answer questions and point out important features.

9 At Taconite Harbor are the Erie Mining Co. docks (map location 9). Taconite pellets are transported here from the company's mine and concentrating plant at Hoyt Lakes over a 74-mile company-owned railroad. At this man-made harbor, one may see on occasion some of the largest ore carriers on the Great Lakes.

Ore carrier being loaded in the Duluth harbor.

10 **Minn. 210.**—Along the south side of the road near Cromwell, one can see areas where peat is being mined (map location 10). Large areas are exposed for air drying. After two days of drying, vacuum vehicles go over the area, picking up 2 inches of dried peat. The large vacuum vehicles suck up the peat into trailers, and it is hauled to a central plant for bagging. The newly exposed surface is then left to dry, and the process is repeated.

Minn. 23.—On the west side of the road at Rockville is a small dimension stone granite quarry (map location 11). There are a number of other quarries in the area between St. Cloud and Cold Spring, the derricks of which can be seen in the distance. 11

U.S. 75.—About 4 miles north of Bellingham, Delano Granite, Inc., operates a quarry on the west side of the road. One can see the derrick and quarry walls and observe how dimension stone is quarried (map location 12). Between Bellingham and Ortonville, the derricks of numerous granite quarries can be seen at a distance. 12

Minn. 22, 14.—A few blocks north of the Mankato business section, on Front Street, the Mankato Stone Co. has a limestone quarry and supply yard on the west side of the road. Visible from the road are the many sizes and shapes of stone produced and stocked by the company. Several of the derricks used to handle the stone are also visible (map location 13) 13

MINES YOU CAN VISIT

During the summer months, three of the large taconite producers offer conducted tours of their operations, and the Tower-Soudan State Park has an underground mine open to visitors.

U.S. 169.—U.S. Steel Corp. offers tours of its Minntac operation from 8:30 a.m. to 4:30 p.m. from July 1 through Labor Day. The tour starts at the Mountain Iron recreational building on Second Avenue, off U.S. 169 in Mountain Iron. The free guided tour on company buses takes about 1½ hours. This plant, in operation since 1967, produces about 12 million tons of taconite pellets annually (map location 4). 4

Minn. 169.—At Soudan, 2 miles northeast of Tower, is the Tower-Soudan State Park (map location 14). 14 Featured in the park is the Soudan mine where underground mine tours are conducted from the third week in May through the first week in September, 11 a.m. to 4 p.m. On the underground tour, visitors are taken 2,400 feet underground on a mine elevator and then on a train ride of 3,000 feet through a tunnel to the mining area. The Soudan mine was operated by the Oliver Iron Mining Co., a subsidiary of U.S. Steel Corp., for 78 years, until it closed in 1962. The mine and surface facilities were donated to the State for this park. Experienced guides explain the mining methods and equipment used in this underground mine. Average temperature in the mine is 50°, so a jacket is recommended. Admission is charged.

County 110.—The Erie Mining Co. tour starts at 12:45 p.m., Monday through Friday from the first Monday in June through the last Friday in August. The tour takes about 2 hours, and visitors are asked to

Minntac taconite mine, Mountain Iron, Minn.

register in advance by calling Erie's public relations office (218-225-7319). Visitors must be 9 years or older, and women are required to wear slacks and low-heeled shoes. The company produces 10.3 million tons of taconite pellets annually. The tour starts at the Erie Administration Building, which is located about 12 miles northeast of Aurora on County 110 (map location 15).

15

16

U.S. 53.—The Thunderbird mine is located just north of the City of Eveleth (map location 16). The mine was opened in 1965 and produces about 6 million tons of crude taconite ore annually for the Fairlane plant located 10 miles to the south where the ore is concentrated. Two bus tours starting at the mine parking lot are scheduled daily, Monday through Friday, at 10 a.m. and 1 p.m. from mid-June through Labor Day. The tour provides visitors a closeup view of trucks and shovels removing surface rock and soil, mining taconite, and jet piercer drills and other related mining equipment. Eveleth Taconite Co., owned by Ford Motor Co. and Oglebay Norton Co. and managed by Oglebay Norton Co., produces 2,100,000 tons of taconite pellets per year.

GHOST TOWNS AND HISTORICAL SITES

17

U.S. 169 and 73.—In Chisholm on West Lake Street, the Minnesota Museum of Mining provides conducted tours of its exhibits of mining equipment (map location 17). The museum is open from Memorial Day through Labor Day, 8 a.m. to 6 p.m. Admission fees are $1.00 for adults and 50 cents for children.

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, P.O. Box 1660, Twin Cities, Minn. 55111.

Lake Superior Industrial Bureau, 828 First American National Bank Building, Duluth, Minn. 55802.

Minnesota Department of Economic Development, Visitor Information Center, 51 East Eighth Street, St. Paul, Minn. 55101.

Minnesota Department of Natural Resources, Bureau of Information and Education, 350 Centennial Building, St. Paul, Minn. 55101.

Minnesota Geological Survey, University of Minnesota, 1633 Eustis Street, St. Paul, Minn. 55108.

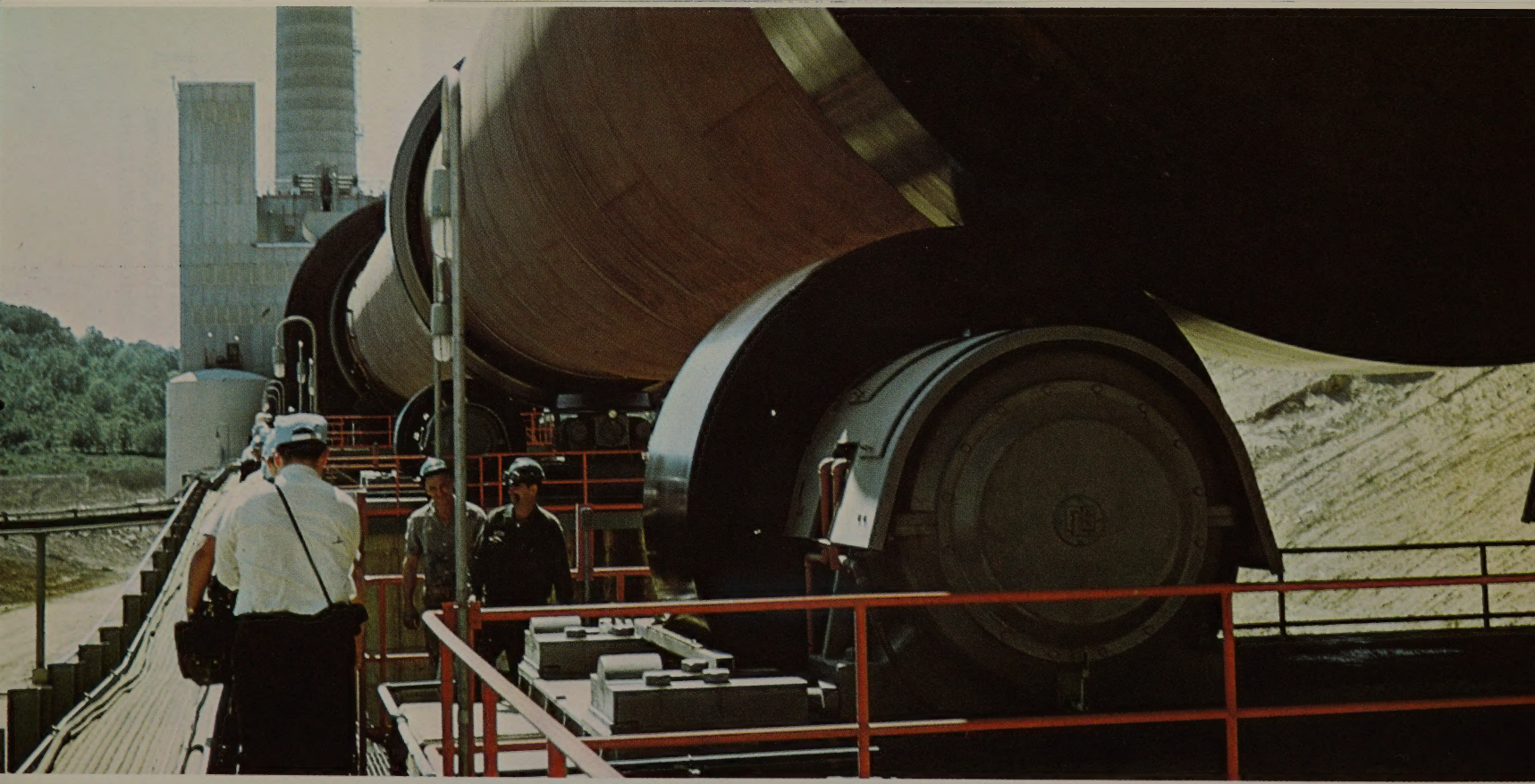
United States Steel Corp. Twin City iron ore mine, Chisholm, Minn.

SELECTED REFERENCES

Minnesota Rocks and Waters: A Geological Story, by G. M. Schwartz and G. A. Thiel. Minnesota Geological Survey Bulletin 37, University of Minnesota Press, Minneapolis, Minn., 1963, 366 pp.

Quest for Ore, by R. H. Bennett. T. S. Dennison & Co., Inc., Minneapolis, Minn., 1963, 410 pp.

Seven Iron Men, by P. D. DeKruif. Harcourt, Brace, and Co., New York, 1929, 241 pp.



Cement kiln of Dundee Cement Co. near Clarksville, Mo.

MISSOURI

by
Joseph C. Arundale

Missouri is one of the oldest and yet one of the most rapidly growing mining and metallurgical centers in the Nation. There is abundant evidence that native Americans since very ancient times knew, produced, and used in many ways a wide variety of minerals and metals in this area now known as Missouri.

Nearly 4 centuries ago, DeSoto and his little band of gold seekers made their way up the Mississippi River to what is now eastern Missouri in search of precious metals. They did not find any, but little did they know that they were walking over one of the most fabulous buried treasures in the world—a treasure worth literally more than all the gold in Fort Knox.

Mine La Motte, the oldest lead mine in the United States, was worked over 250 years ago by Frenchmen moving west into the wilderness. From that, through a long and fascinating history, grew the minerals industry of Missouri today.

Missouri mineral output has tripled in the past decade to nearly three-quarters of a billion dollars annually of lead, zinc, copper, iron, silver, barite, coal, stone, and other assorted minerals and metals.

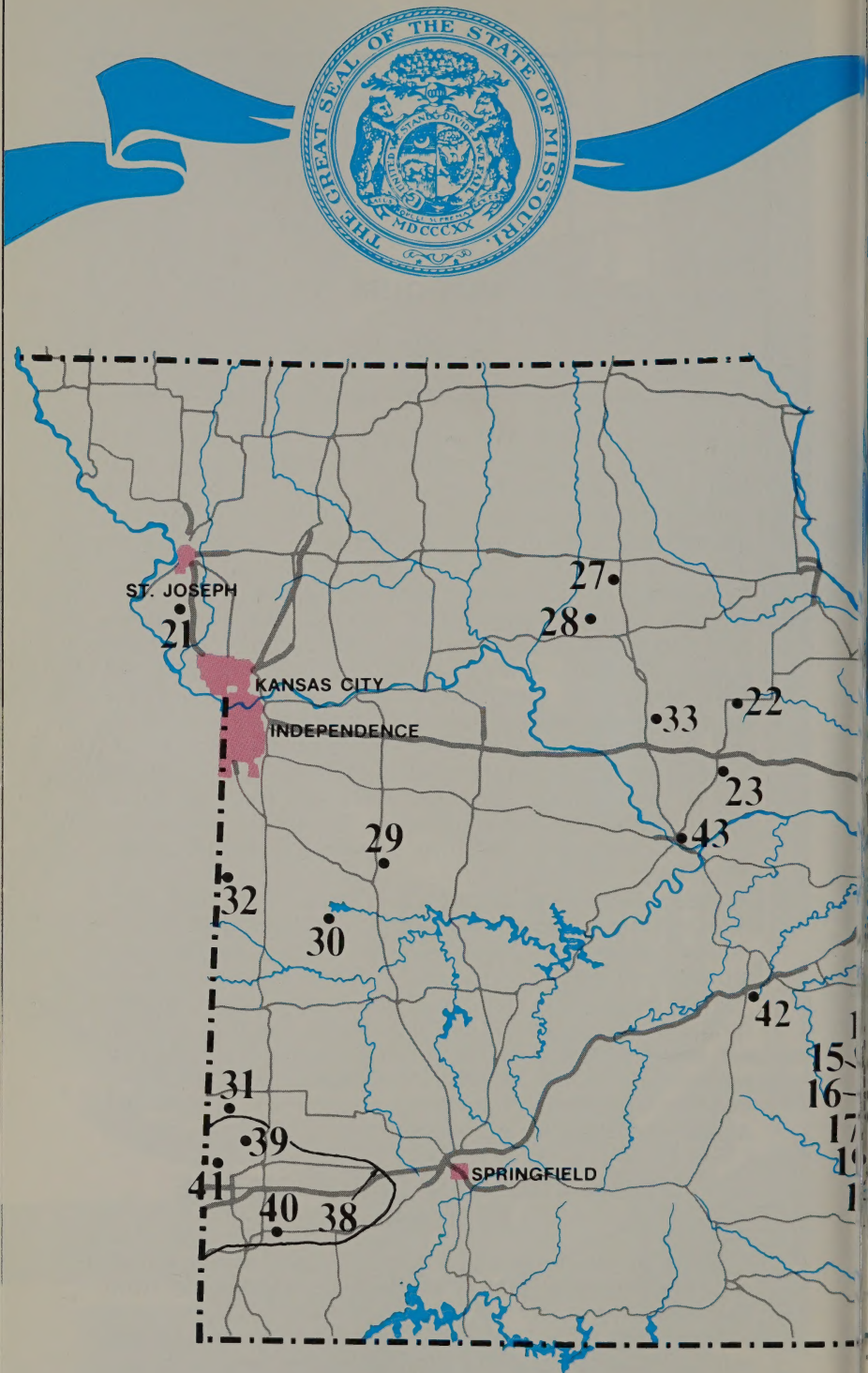
This fascinating history, from its aboriginal beginnings in remote antiquity through the Spanish explorers and treasure hunters and the French frontiersmen and miners to the variety, immensity, and complexity of Missouri's modern minerals industry, is spread out across the State for the visitor to see.

MINES YOU CAN SEE FROM THE HIGHWAYS

Many of the more important and spectacular mines and metallurgical plants in Missouri are visible from the highways.

Interstate 55.—This great arterial highway and the mighty Mississippi River alongside are lined with history.

About 30 miles south of St. Louis on Interstate 55 (turn off east at Pevely) on the banks of the Missis-


ST. JOSEPH
21
KANSAS CITY
INDEPENDENCE
27
28
33
22
23
43
29
32
30
42
31
39
41
40
38
SPRINGFIELD

LEGEND

1— Lead smelter, St. Joe Minerals Corp., Herculaneum
2— Stone quarry and lime plant, Mississippi Lime Co., Ste. Genevieve
3— Stone quarries, Marquette Cement Manufacturing Co., Cape Girardeau
4— Alumina reduction plant (aluminum smelter), Noranda Aluminum Co., near New Madrid
5— Pea Ridge mine of Meramec Mining Co.
6— Indian Creek mine of St. Joe Minerals Corp.
7— Goose Creek mine of St. Joe Minerals Corp.
8— Barite district of Washington County centered on Potosi
9— Pilot Knob iron mine of Pilot Knob Pellet Co.
10— Lead smelter of American Smelting and Refining Co. (ASARCO), at Glover
11— Roofing granules, stone quarry and manufacturing plant of GAF Corp. at Annapolis
12— "Viburnum Trend" or "New Lead Belt"
13— Viburnum Div. of St. Joe Minerals Corp.
14— Magmont mine of Cominco-American, Inc.
15— Lead smelter of AMAX Lead-Zinc Co.
16— Buick mine of AMAX Lead-Zinc Co.
17— Brushy Creek mine, St. Joe Minerals Corp.
18— Fletcher mine of St. Joe Minerals Corp.
19— Adair Creek mine of Ozark Lead Co.
20— Stone quarry of Fred Weber, Inc.
21— Clay and lightweight aggregate plant, Carter-Waters Corp.
22— Part of the northeast Missouri clay and refractories industry
23— Clay and refractories center of Fulton
24— Limestone quarry and cement plant of Dundee Cement Co.
25— Industrial sand pit of Pennsylvania Glass Sand Corp.
26— Gravel pit, Lemons Gravel Co.
27— Bevier mine of Peabody Coal Co.
28— Prairie Hill mine of Peabody Coal Co.
29— Tebo mine of Peabody Coal Co.
30— Power mine of P & M Coal Co.
31— Empire mine of P & M Coal Co.
32— Midway mine of P & M Coal Co.
33— Finger Lakes State Park Reclamation-for-Recreation Project
34— Commercial "tourist" mine at Bonne Terre
35— Old silver mines area in Clark National Forest
36— Old Lead Belt in Bonne Terre/Flat River area
37— Mine La Motte
38— Old Tri-State zinc-lead district
39— Oronogo—early lead mining area
40— Granby—famous "boomtown" of the Old Tri-State
41— Schifferdecker Mining Museum
42— Missouri School of Mines and Metallurgy and Missouri Geological Survey, Rolla
43— State Capitol Building mining exhibits, Jefferson City

1 sippi River is Herculaneum, site of the largest lead smelter in the Nation (map location 1). Herculaneum is one of the oldest towns in Missouri and has been a "smelter town" all its life (see discussion under "Ghost Towns and Historical Sites"). St. Joe Minerals Corp. smelts nearly a quarter million tons of lead annually in this facility. Most of the raw material is "galena concentrates" from mines about 100 miles southwest of Herculaneum in the Ozark Hills (see discussion of the "Viburnum Trend" on pages 66 to 68).

The largest lead smelter in the United States, operated by St. Joe Minerals Corp. at Herculaneum, Mo.

2 At Sainte Genevieve, a large limestone quarry can be seen from the highway (map location 2). This quarry provides the raw material for one of the largest lime plants in the country, and it too can be seen from the highway.

3 In Cape Girardeau, east of the intersection of U.S. 61 and Missouri 75, are two unusually deep stone quarries—spectacular man-made chasms (map location 3).

Continuing south on Interstate 55 to New Madrid County, the traveler can see, a mile or so east of Marston on the west bank of the Mississippi River, the alumina reduction plant of Noranda Aluminum Co. (map

location 4). Alumina is shipped by barge to this facility from bauxite processing plants in Louisiana for reduction to aluminum metal. The metal is then fabricated into aluminum bars, rods, and cable in a contiguous plant. 4

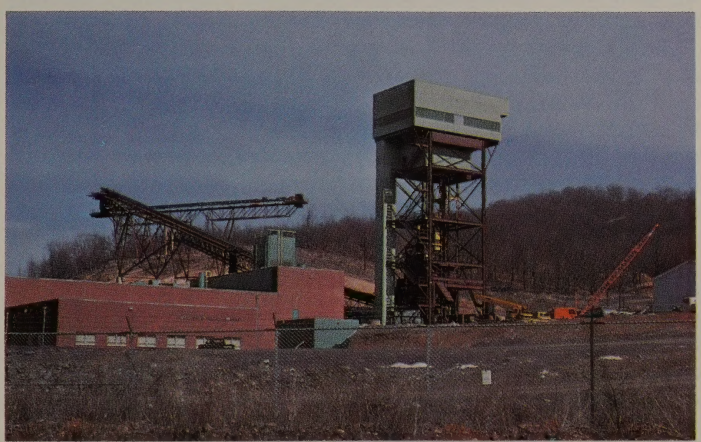
Nearly all of Missouri south of Interstate 44 and west of Interstate 55 is Ozark hills. The roads leading off these two interstate highways will take you into some of the most important and historic mining areas in the world.

Interstate 44.—Southeast of St. Louis, about 50 miles on Interstate 44 at Sullivan, Mo. 185 leads south. About 12 miles on this road, a sign will direct the traveler to the Pea Ridge iron mine of Meramec Mining Co., 2 miles over a dead end Highway EE (map location 5). Iron ore is produced from an underground deposit and concentrated to pellet form. About 2 million tons of these high-grade iron pellets are shipped annually to steel mills in the Midwest. 5

A few miles further south on Mo. 185 very close to the road is the Indian Creek mine (lead, zinc, copper) of St. Joe Minerals Corp. (map location 6). On the east side of the road and in the distance can be seen the headframe of St. Joe's Goose Creek mine (map location 7). 6 7

From Potosi, highways and roads leading in all directions finger out into the barite-producing district of Washington County where barite has been produced for well over a century to be used chiefly as a weighting agent in oil well drilling fluids (map location 8). 8

Following Mo. 21 south out of Potosi about 20 miles, the traveler arrives at Pilot Knob where another underground iron mine is operated by Pilot Knob Pellet Co. (map location 9). An old open pit iron mine 9



Surface facilities of Pilot Knob Pellet Co., an underground iron mine near Pilot Knob, Mo.

can be seen at the top of Pilot Knob, a prominent topographic feature nearby.

Continuing on Mo. 21 south to Glover, the large, modern lead smelter of ASARCO is visible on the west
10 side of the road (map location 10).

On to Annapolis, a few miles further, the GAF Corp. has a hilltop quarry producing a hard stone used in manufacturing colored roofing granules (map location
11 11).

Viburnum Trend.—The so-called Viburnum Trend, or new lead belt, is in eastern Iron County and Rey-
12 nolds County (map location 12). Viburnum Trend is a name widely used to designate an alinement of mineral deposits irregularly en echelon horizontally and vertically running from the southwest corner of Washington County north-south through western Reynolds and Iron Counties and into northeastern Shannon County in southeastern Missouri. The Viburnum Trend is a huge mineralized area roughly 40 miles long and half mile wide in a north-south position in southeastern Missouri.

The Viburnum Trend takes its name from the village of Viburnum near which a drill hole first revealed the major lead deposits in this area. The Viburnum Trend is almost continuously mineralized at depths ranging from about 800 feet to about 1,400 feet and from a few hundred yards to about 2 miles wide. It contains lead-zinc-copper-silver ore varying widely in grade. Although there are no official estimates of grade and reserves, unofficial estimates by geologists and others familiar with the area have run as high as 1 billion tons of ore containing 20 to 30 million tons of lead metal.

These startling statistical facts make the Viburnum Trend one of the world's largest and richest deposits of lead and the most important lead discovery in this country.

The major valuable element in the Viburnum Trend ore is lead. The grade of ore being mined at present is highly variable, but much of this ore averages in the range of 4 to 6 percent lead, although much lower grades are encountered, as are much higher grades in limited areas. The lead occurs as disseminated but clearly defined crystals of galena (PbS) in a gangue of dolomite or dolomitized limestone.

The zinc in Viburnum Trend ore occurs as sphalerite crystals widely disseminated but unevenly distributed throughout the deposits. Sphalerite content of the ore presently mined is extremely variable, but overall averages are on the order of one-half of 1 percent zinc.

Chalcopyrite and bornite are the principal copper minerals in Viburnum Trend ore. Grade is even more variable than that of zinc but on the average is no

more than half as plentiful. Silver occurs in minute concentrations, presumably in the sphalerite crystals. The gangue rock is dolomite or dolomitized limestone with present value and even larger future commercial potential.

Several roads and highways lead into and through this mining and metallurgical complex. Leaving Interstate 44 at Cuba, Mo. 19 to Cherryville and Mo. 49 leads to Viburnum. Here, St. Joe Minerals Corp. has its headquarters and a major lead, zinc, copper mining operation at this small but new and modern mining town—a far cry from the tin-roofed tarpaper shacks many people associate with mining camps of yesteryear (map location 13). From Viburnum, the mining district extends in a nearly north-south direction into eastern Reynolds County. Driving from north to south on Highway KK from near Bixby to near Reynolds, travelers can see several other large, new, modern lead, zinc, and copper mines, mills, and a large lead smelter.

13

South along the trend near Bixby is the Magmont mine of Cominco-American, Inc., and Dresser Industries (a joint venture) (map location 14). Development and construction at the Magmont mine began in 1965. After 3 years of work costing over $18 million, the operation started production in 1968 and is now producing above design capacity of 50,000 tons of lead annually.

14

About 2 miles south of Mo. 32 on secondary road KK, south of Bixby, can be seen the first lead smelter built (1968) in the United States since World War I (map location 15). It is operated on a "toll basis" by AMAX Lead-Zinc Co., which takes lead concentrates from the Magmont mine and from AMAX's Buick mine

15

Facilities for removing sulfur from lead smelter gases at the lead smelter of Amax Lead Co. of Missouri near Bixby, Mo.

16 about a mile further south on KK (map location 16). This smelter produces over 100,000 tons of lead metal a year.

17 A few miles further south on KK is the Brushy Creek mine of St. Joe Minerals Corp.—the newest mine in the Viburnum Trend (map location 17).

18 Still continuing south on KK to the intersection with secondary road TT, the traveler can get a good high-angle view of St. Joe's Fletcher mine (watch for the sign) (map location 18).

19 Ozark Lead Co. has developed the Adair Creek mine about half-way between Ellington and Bunker on secondary road BB (map location 19). The Adair Creek mine-mill has an annual capacity of about 70,000 tons of lead concentrates (60,000 tons of lead metal).

Surface facilities of Ozark Lead Co. a few miles south of Reynolds, Mo.

Adding up these operations gives eight production shafts and six mine mills—with a total capacity of the equivalent of about 500,000 tons of lead metal a year, perhaps 60,000 tons of zinc metal, 25,000 tons of copper metal, and over a million ounces of silver.

Over 80 percent of the lead produced in the United States these days comes from the Viburnum Trend. So, there is an excellent chance that the lead metal in your car battery came from these mines and smelters.

Interstate 70.—Northwest of St. Louis, on Interstate 70 a few miles west of St. Charles, is an excellent example of a large stone quarry—the backbone of the minerals industry of Missouri. This one is operated by

20 Fred Weber, Inc. (map location 20). Driving along this main highway between St. Louis and Kansas City, the tourist can get glimpses of several smaller stone quarries; for example, on the north side of the road

just east of the Blackwater River crossing east of Sweet Springs is a good view of a well-organized crushed stone operation.

Interstate 29.—In the far northeast part of the State on Interstate 29 near the small town of New Market (about halfway between Kansas City and St. Joseph) the Carter-Waters Corp. is mining shale from an open pit and making a lightweight aggregate in a large rotary kiln (map location 21). 21

U.S. 54.—In northeast Missouri, the highways and roads leading through Audrain, Callaway, and Montgomery Counties pass through an old and famous clay and refractories area. Many abandoned clay pits and active clay operations can be seen in this area. Ask for directions locally. Refractories manufacturing plants utilizing this clay are located at Mexico (map location 22) and Fulton (map location 23). 22 23

Mo. 79.—South of Hannibal, along Mo. 79, the Great River Road, just north of Clarksville, is one of the largest cement operations in the world. A nearby limestone quarry providing the raw material is clearly visible from the road. (map location 24). 24

Mo. 94.—Between Defiance and Augusta, east of St. Louis along the north bank of the Missouri River, the traveler can get an excellent view of a large sand mining operation. This industrial sand is shipped to glass plants and used for a wide variety of other purposes. (map location 25). 25

U.S. 60, Mo. 25.—A few miles north of the intersection of U.S. 60 and Mo. 25 (north of Dexter) west of the highway is a good example of an upland gravel pit (map location 26). It is operated by Lemons Gravel Co. 26

Most recent estimates show a total coal resource of nearly 50 billion tons of coal in the State. This is ample to support an expanded coal mining industry. The principal use of Missouri coal is for firing electric-generating plants. Eventually, this coal may also be converted to gas or liquid fuels. The principal coal mining districts of Missouri are in the north-central and west-central parts of the state.

U.S. 63, 36, and 24.—Several operating coal strip mines can be seen in Macon and Randolph Counties, but they can be reached only by secondary roads. Ask locally for directions. The Bevier mine of Peabody Coal Co. a few miles southwest of Macon (map location 27) and the Prairie Hill mine a short distance below the dam of the Thomas Hill Reservoir (map location 28), supply about 1¾ million tons of coal annually to the coal-fired Thomas Hill electric-generating plant of Associated Electric. 27 28

In the west-central part of the State, Mo. 7 and 13 through St. Clair and Henry Counties and U.S. 71 through Bates and Vernon Counties pass through an

old but still active coal mining area. The Tebo mine of Peabody Coal Co. is just east of Mo. 13 north of Clinton (map location 29). The Power mine of P & M Coal Co. is located a mile or so southwest of Montrose on Mo. 52 and supplies coal to the coal-burning generating plant of Kansas City Power and Light Co. at Montrose (map location 30).

29

30

U.S. 160.—Travelers on U.S. 160 in Barton County can take secondary road M about 6 miles south to the southwest corner of Barton County and see a surface coal mine using the most modern equipment, newest mining techniques, and excellent reclamation procedures (map location 31).

31

Largest Coal Mine.—To see the State's largest coal mine, travelers on Mo. 18 or 52 may take secondary road Y to a point just southwest of the small town of Amsterdam (map location 32). This new mine is an excellent example of the new trend to integrate coal mine and power plant operations—the stacks of the mine-mouth powerplant can be seen across the line in Kansas near La Cyne.

32

Many of the highways in northern and western Missouri run over huge buried coal deposits, so don't be surprised if you see a new coal mine being developed or a coal gasification plant being constructed. . . . plans are underway.

Strip mining of coal is of great public interest, and the proper reclamation of surface-mined areas is a legitimate public concern. Reclamation is a process of restoring surface-mined land to useful purposes. Modern mining practices require miners to minimize any adverse effects on the land's productive potential. Still, many thousands of acres of old "orphaned" mined land exists in Missouri that must be reclaimed to productive uses and to protect the environment from sedimentation of streams and acid flushes.

Mo. 126.—Some good examples of proper reclamation practices and multiple use of coal lands can be seen at the Empire mine of P & M Coal Co. just south of Mo. 126 near the western end of the Jasper-Barton County line about 20 miles north of Joplin (map location 31).

31

The U.S. Department of Interior has established a national program to help restore lands disturbed by surface mining. Part of this program recognized recreation as one of the useful purposes for which surface-mined lands could be reclaimed. The Bureau of Outdoor Recreation, with responsibility to coordinate the reclamation-for-recreation program, included a demonstration or pilot program in each region.

Finger Lakes Project.—In 1972, the Missouri State Park Board located a suitable site in Boone County, north of Columbia. The area contained coal strip mines and was donated by Peabody Coal Co. for use

as a demonstration park (map location 32).

32

The Finger Lakes Project is the effort in Missouri to demonstrate reclamation-for-recreation as a State park on coal strip-mined lands. The Department of Recreation and Park Administration, University of Missouri-Columbia, was asked to plan the new State park.

U.S. 63.—The project site, now known as Finger Lakes State Park, lies 6½ miles north of Columbia on U.S. 63. By Interstate 70 and U.S. 63, Finger Lakes State Park is approximately 135 miles from Kansas City and 130 miles from St. Louis (map location 33).

33

Although farming was the land use of the site for many decades, surface mining for coal has primarily given the site its special characteristics. Surface mining disturbed nearly 75 percent of the area. The undisturbed part of the area features the relics of earlier farming: Pastures, old tilled areas, farm sites, and farm woodlands. Portions of the site have been used for a motorcycling area. The project site has also been used for hunting, fishing, shooting, and swimming.

Small portable sand and gravel operation on the Big River flood plain in southeast Missouri. Such operations are moved frequently and can be seen at several places in the State where roads cross streams and rivers.

Surface mining for coal by the area method was used on the project site, leaving parallel ridges of spoil material and random-oriented spoils. This left a unnatural appearing landscape from any perspective. Soon after mining operations ceased in one section of the site, reclamation efforts began. Trees were planted, legumes and grasses were seeded by helicopter and by hand to produce a vegetative cover to stabilize the spoil materials. These operations were directed by the coal company's forester and carried out primarily by college students. As a result, much of the areas disturbed by mining operations now are vegetated.

On the State level, the park is to provide the knowledge and understanding required to reclaim surface mined lands in other parts of the State.

MINES YOU CAN VISIT

At Bonne Terre in St. Francois County in east-central Missouri near the intersection of Mo. 47 and U.S. 67, an abandoned, underground lead mine has been converted to a combination museum and commercial tourist mine (map location 34). During the 100 years of mining operations in the Bonne Terre mines, over 30 million tons of ore were removed, leaving stopes (underground rooms) with heights up to 200 feet. These enormous rooms, the huge pillars supporting the overlying formations, a billion-gallon underground lake, and relics of the old mining operations can be seen on guided tours.

34

From Mo. 72 at about 6 miles west of Fredericktown, a secondary road (Mo. D) leads to the old silver mines area in the Fredericktown ranger district of Clark National Forest (map location 35). Mining began here in 1877 when the Einstein Silver Mining Co. drove the first tunnels and shafts. In 1879, a dam was constructed across the St. Francis River, and a turbine wheel was installed. A smelting furnace, machinery for hoisiting the ore, a crushing machine, and other buildings were constructed. On the hill about one-half mile southwest of the mine, a town was laid out. A post office was established along with a school, blacksmith shop, and several stores. At the height of activity, the miners and their families made up a village with a population of 800.

35

Today, the miners and their town are gone. Oak and pine trees again grow where once men walked city streets. Operation of the mine ceased after a few years, with the production of 50 tons of lead and 3,000 ounces of silver. Traces of gold were also found. The mine was reopened in 1916, and small amounts of tungsten were mined intermittently until 1946. Although there is a great variety of minerals

present in the veins, they never proved to be abundant enough to justify the heavy investments necessary to carry on a viable mining enterprise.

The property was purchased from the Silver Dam Realty and Mining Co. by the U.S. Government for national forest purposes in 1938. A picnic and camping area has been constructed. Tour guide booklets are available from the District Ranger, Clark National Forest, Fredericktown, Mo. 63645.

GHOST TOWNS AND HISTORICAL SITES

Artifacts from burial mounds in the Mississippi Valley show that Indians long ago knew the lead, iron, and copper in southeast Missouri. Fine axe blades, knives, weights, ornaments, and other useful objects prove that those people could mine, smelt, and fashion the metals.

Organized, commercial mining was done as long ago as 1709 when Charles Renault came across the Mississippi River from Illinois to mine lead in what is now called the Old Lead Belt in the area around Potosi, Bonne Terre, and Flat River (map location 36). Lead mining was carried on almost continuously since that time. Over a century ago, St. Joe Minerals Corp. came into the Old Lead Belt and mined lead continuously until 1973 when the area was abandoned because of depletion of reserves of ore that was economically minable.

36

Although towns like Bonne Terre and Flat River cannot be called ghost towns because they are growing and thriving, the area has been abandoned as a lead mining district. Many huge piles of waste rock—commonly called tailings piles—and slime ponds bear mute testimony to centuries of mining in the area.

DeSoto's Goldhunters.—In 1542, DeSoto recorded the first entry of the white man into southeast Missouri. After marching along Crowley's Ridge in the St. Francis Basin, DeSoto and his goldhunting fellow Spaniards crossed a bend of the old Mississippi River channel from what is now Scott County. From there, DeSoto sent two of his men, DeSilvera and Moreno, and some helpers north to LaSaline for salt. Thus southeast Missouri was penetrated more than 400 years ago. But it was to be a century and a half before white men arrived in the region to stay and begin mining.

Mining In Missouri. The famous Mine La Motte lead deposits were described in 1701 by Henri de Tonti as . . . "lead deposits that would yield two parts of ore to one of refuse" (map location 37).

37

However, commercial lead mining and smelting in southeast Missouri did not begin until several years later when a number of French expeditions entered

the area to explore for gold and silver but instead found only the lead. The earlier of these expeditions were not very successful in producing lead, mainly because they lacked technical knowledge, did not have the proper tools, and were otherwise unprepared for the difficulties encountered in developing a mining area.

Renault—For The French Company Of The Indes. —One of the better prepared expeditions was under the leadership of the French explorer Phillip Renault who, under authority of a patent from the French Government issued to John Law's Co., moved up the Mississippi River from New Orleans to Kaskaski, Ill., in 1718 in search of gold and silver.

Lead was not mined seriously in Missouri until about 1720 when Renault sent out exploring parties who soon found those lands where previous parties had reported finding lead. Renault, armed with grants from officials at Fort Chartres, crossed the river and set his men to work mining the rich lead ore. One of Renault's grants covered two leagues of ground in what is now Madison County where the lead deposits described by Henri de Tonti were named Mine La Motte in honor of Renault's mineralogist, Cadillac La Motte. This mine is the oldest lead mine in the United States and contained the vein that proved to be one of the richest natural concentrations of lead ore ever discovered in the world. The mine was worked intermittently from about 1720 to 1780 and since then has been operated almost continuously until recent years.

Renault and his company also found residual lead in surface clays near what is now Potosi in Washington County. By 1725, Renault had built a furnace and was gouging out 1,500 pounds of lead a day. By 1726, he had also opened a lead mine at Old Mines (map location 8).

8

The company had financial troubles, and by 1731 the grants reverted to the French Crown and Renault headed for the Illinois country before returning to France in 1744.

Throughout the 1700's, lead mining was carried on by anyone with an inclination and a show of surface lead. The mines, as such, were nearly all open pit arrangements. The crude smelting of the day was conducted near the mines, and the lead was transported on mules and horseback to the Mississippi, where it was carried to New Orleans on keelboats.

The first Americans in the Bonne Terre area settled Spanish land grants on Big River in 1794. In the latter part of the 18th century, Moses Austin, an outstanding American and shrewd businessman, was attracted to the area. Austin came to Missouri from Connecticut, where he heard of the vast mineral resources west of the Mississippi. He was much interested in the

accounts of lead mining in Missouri, and in 1797, he obtained a land grant from the Spanish Government in St. Louis, consisting of 4,400 acres in what is now Washington County (map location 8). He received his grant in consideration of "erecting furnaces and other works for prosecuting the mining business" in the land area around Mine-a-Breton. 8

The lead belt was to supply much of the Nation's lead needs to fight its biggest war ever, promote its greatest industrial expansion, start its nuclear age, and launch it into space! And so . . . in a century, the diamond drill and dynamite found and extracted more than a quarter billion tons of ore containing 10 million tons of lead, 2 million tons of zinc, and several million dollars of silver.

Then in the 1960's, the Old Lead Belt was fading fast—tonnage dwindling, grade dropping, reserves disappearing. But, as a great mining district was dying, a new mining district was being born—the Viburnum Trend—destined to be even greater than its predecessor.

Old Tri-State Zinc-Lead Mining District.—In southwest Missouri around Joplin (and extending into extreme northeast Oklahoma and southeast Kansas) is the old Tri-State zinc-lead mining district. The district was for many years the Nation's principal zinc-producing area and was mined from the mid-1800's until the mid-1900's (map location 38). The area is now abandoned as a mining district, but there are many remaining ghost towns and historical sites in that area. Along Interstate 44, U.S. 66 and 60, Mo. 96 and U.S. 71, which crisscross Newton and Jasper Counties, can be seen many huge piles of tailings. resembling barren white mountains, many old abandoned zinc-lead mills and headframes and other relics of the camps in what was once a "rip-roaring" mining district. 38

One of the earliest mentions of minerals or mining in southwest Missouri was of crude surface mining for lead near Oronogo, north of Joplin on Mo. 96 (map location 39). 39

U.S. 60 passes through Granby, one of the most famous boomtowns in the old Tri-state (map location 40). 40

The history of this old Tri-State district is commemorated in a mural painted by the famous artist Thomas Hart Benton in the Post Office Building in Joplin.

Schifferdecker Mining Museum.—In Schifferdecker Park on U.S. 66 in the west outskirts of Joplin, is a museum with many historical records, relics, and exhibits of the old Tri-State mining district (map location 41). 41

Rolla School Of Mines.—In 1870, there was estab-

lished in Rolla, Mo., a Missouri School of Mines and Metallurgy (MSM). The Board of Curators, on July 1, 1964, took action to rename MSM the University of Missouri-Rolla (UMR). The School of Mines and Metallurgy is one of the foremost mining schools in the Nation. Its graduates are scattered throughout the world and many have established themselves in the highest circles of mining and governments worldwide. A visit to this mining school in downtown Rolla is a rewarding experience for any student of mining (map location 42).

42

Missouri Geological Survey.—The Missouri Geological Survey, with headquarters in the eastern edge of Rolla, very near Interstate 44, is one of the finest examples of State surveys. Its mineral museum, art exhibits, and its facilities make an interesting stop for travelers (map location 42).

42

Flat River Mining Museum.—The city of Flat River, Mo., has established—at the intersection of Highways 8 and Business 67—a mining museum with many historical records, relics, and exhibits of lead mining in the Old Lead Belt. This museum is open from May to September; a small admission fee is charged.

Mineral And Mining Exhibits In The State Capital.—In the State Capitol Building in Jefferson City, there is an interesting exhibit of the mineral resources and the mining industry of Missouri. It is free to the public—ask at the information desk in the Rotunda for directions. Jefferson City is in the center of the State at the intersection of Highways 54, 63, and 50 (map location 43).

43

A sand-washing operation across the Missouri River from the Missouri State Capitol. The plant can be seen from U.S. 63 and U.S. 54 just north of Jefferson City or from Mo. 94 east of Cedar City.

FOR MORE INFORMATION WRITE OR VISIT

Mining Industry Council of Missouri, 210 Monroe Street, Jefferson City, Mo. 65101.

Missouri Department of Natural Resources, Division of Research and Technical Information, P.O. Box 250, Rolla, Mo. 65401.

Missouri Limestone Producers Association, P.O. Box 263, Jefferson City, Mo. 65101.

State Historical Society of Missouri, Hitt and Lowry Streets, Columbia, Mo. 65201.

Tourism Commission, Department of Community Affairs, Regulations and Licensing, Jefferson, Mo. 65101.

SELECTED REFERENCES

Geological Highway Map of the Mid-Continent. American Association of Petroleum Geologists, U.S. Geological Highway Map Series, Map 1.

List of Publications and Maps. Missouri Geological Survey, P.O. Box 250, Rolla, Mo. 65401.

Mineral Industry of Missouri. Federal Bureau of Mines, Minerals Yearbook chapter, annual publication.

Mineral Industry News. Missouri Geological Survey, monthly publication, 1961 to 1974 (discontinued December 1974).

Missouri Environment. Missouri Department of Natural Resources, monthly publication beginning January 1975.

Missouri Minerals. Missouri Geological Survey and Water Resources, Special Publication No. 1, December 1969, 303 pp.

Missouri: The Sesquicentennial of Statehood. U.S. Library of Congress, State Exhibition Catalog Series, 1971, 93 pp.

Official Manual. State of Missouri, published biennially.

The Story of Joplin, by D. Shaner. Stratford House, New York, 1948, 144 pp.

Tales About Joplin, by E. M. Jones. Harragan House, Joplin, Mo., 1962, 148 pp.

Wilderness Bonanza—The Tri-State District of Missouri, Kansas, Oklahoma, by A. M. Gibson. University of Oklahoma Press, Norman, Okla., 1972, 362 pp.

Limestone crushing plant for underground room-and-pillar mine of Kerford Limestone Co. at Weeping Water, Nebr.

NEBRASKA

by
Harry F. Robertson

Mining in Nebraska is limited to nonmetallic minerals and petroleum products. The bulk of the nonfuel mineral output consists of materials such as clay, limestone, and sand and gravel taken from quarries and pits, mostly near urban centers in the State. Almost all of the mines are surface operations (three limestone quarries in Cass County have been converted to underground operations). Output of the mines is used in construction of roads, buildings, and dams or for the manufacture of cement, limes, brick, and other commodities.

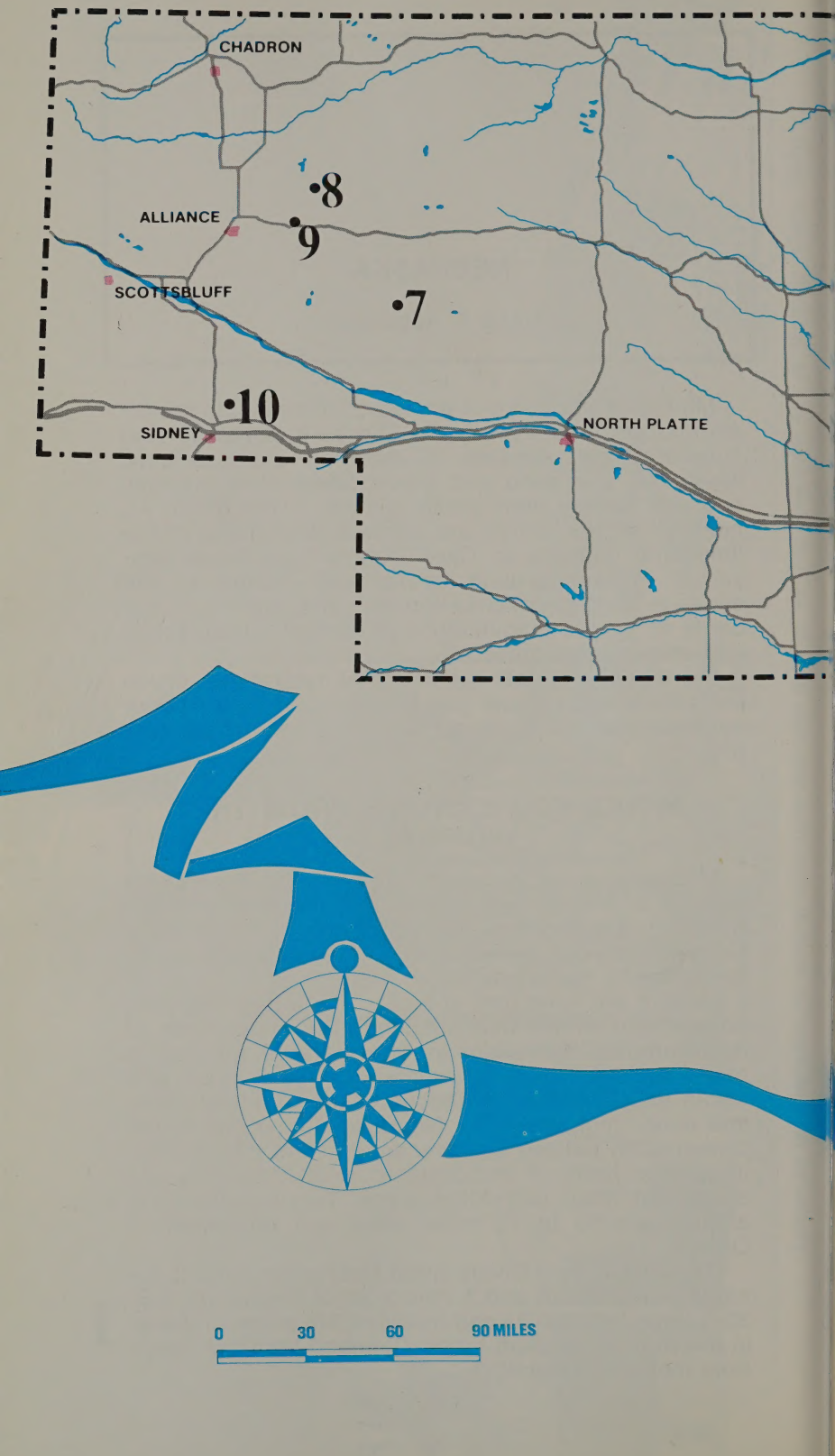
Petroleum products consisting of natural gas, crude petroleum, and natural gas liquids account for about 40 percent of the value of the State's mineral production.

MINES YOU CAN SEE FROM THE HIGHWAYS

Nebraska is an excellent area for the rockhound looking for fossils, gem stones, or mineral specimens. Recent publications of the University of Nebraska—Conservation and Survey Div., contain a wealth of information for the amateur.

Most of the sand and gravel produced in Nebraska comes from stream deposits along the Platte River or its tributaries. Extraction of the material for use in roads and buildings left numerous water-filled pits within easy traveling distances of the principal cities and major highways. The Nebraska Game and Parks Commission utilized the abandoned sand pits at sites in various parts of the State to form State wayside areas and State recreation areas. Two excellent examples are 10 to 15 miles west and northwest of Omaha.

U.S. 30-A.—Two Rivers State Recreation Area is located 1 mile south and 1 mile west of Dennis on U.S. 30-A (map location 1) and includes 320 acres of water in the form of sand-pit lakes. Camping facilities range from modern to primitive. 1


CHADRON
ALLIANCE
SCOTTSBLUFF
SIDNEY
NORTH PLATTE
8
9
7
10
0
30
60
90 MILES

LEGEND

1— Recreation area created from former sand pits
2— Recreation area created from former sand pits
3— Limestone quarries
4— Limestone quarries and crushing plants
5— Recreation area created from former sand pits
6— Recreation area created from former sand pits
7— Largest sand dune area in the Western Hemisphere
8— Alkali lake area
9— Remains of potash processing plants
10— Denver-Julesberg Petroleum Basin

U.S. 30.—Another excellent example of mined-land reclamation is found northwest of the Two Rivers State Recreation Area. Three miles west of Fremont on U.S. 30, 20 sand-pit lakes have been converted into the Fremont Lakes State Recreation Area (map location 2). Facilities include picnic tables, fireplaces, water, lights, toilets, a shelter house, and boat launch facilities. The lakes are stocked with various kinds of fish.

2

Nebr. 50.—South of Omaha in Cass County, high-grade limestone formations outcrop and are quarried extensively. About 18 miles south of Omaha on Nebr. 50, the newly modernized cement plant of Ashgrove Lime and Portland Cement Co. adjoins the highway. Quarries supplying limestone to the plant are 2 to 3 miles east of the town (map location 3). Nine miles further south, active quarries and crushing plants are easily seen from Nebr. 50-A between the 50— 50-A intersection and Weeping Water. Off-road viewing sites are found at most of the operations (map location 4).

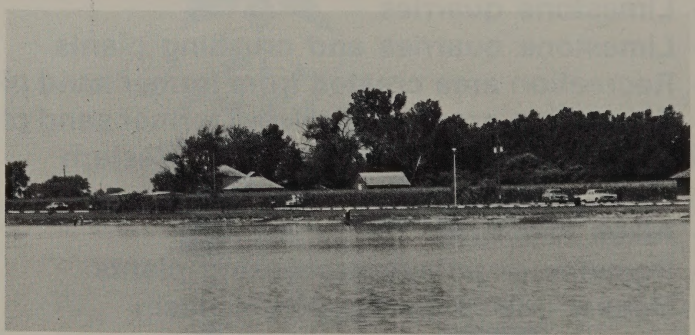
3

4

Interstate 80.—Construction of the Interstate Highway and its many overpasses required a tremendous amount of fill. "Borrow" pits, dug to supply the extra material, normally become water filled and form small shallow lakes at almost every interchange. Many have been made into public miniparks complete with primitive camping facilities. At the Grand Island Exit, and about 30 miles further west at the Gibbon Exit, sand pits and historic sites were utilized by Nebraska Game and Parks Commission to develop park areas known as State wayside areas. Activities offered include camping, swimming, boating, and fishing. Mormon Island State Wayside Area is located at the Grand Island interchange of Interstate 80 and U.S. 281 (map location 5). Windmill State Wayside Area is adjacent to the Gibbon interchange (map location 6).

5

6



Reclaimed construction material pit seen from Interstate 80 near Grand Island, Nebr. The facility is the Mormon Island recreation area, a State wayside area, and offers camping facilities in addition to those services shown.

Hopper Bros. Quarries Ltd. crushed limestone quarry at Weeping Water, Nebr.

Nebr. 61.—Continue west on Interstate 80, exit at Ogallala, and take Nebr. 61 north to traverse the Sand Hills region, by far the largest sand dune area in the Western Hemisphere. Viewed from the air, most of the Sand Hills region appears similar to a choppy sea; each hill resembles a wind-driven wave (map location 7).

7

Nebr. 4, Nebr. 250.—Go 38 miles west from the Nebr. 2-Nebr. 61 intersection to Lakeside, then turn north on Nebr. 250 to traverse the Sand Hills Lakes area. The Sand Hills area is dotted with a total of 1,640 lakes, ranging in size from 10 to 2,300 acres. All are shallow; the average measured depth was 3.2 feet, and the maximum measured depth was 13.8 feet. Many of the lakes are high in salt concentration and are called alkali lakes. During World War I, some of the alkali lakes in southwestern Sheridan County were such an important source of potash that, for a short time, Nebraska led the Nation in production. After the war, however, cheaper imports and the discovery of large reserves in New Mexico made production of potash in Nebraska unprofitable, and the once thriving communities of Antioch, Hoffland, and Lakeside have since disappeared (map location 8). Remains of old processing plants are visible along Nebr. 2 (map location 9).

8

9

Interstate 80, U.S. 30.—The principal oilfields in Nebraska, part of the Denver-Julesberg Petroleum Basin, lie in southwest Nebraska. Oil well drilling and pumping units mark well sites and fields along the

140 miles of highway between Ogallala, Nebr., and Pine Bluffs, Wyo. Detailed information may be obtained from the Nebraska Corporation Commission at Sidney (map location 10).

10

Reclaimed sand and gravel pit south of Interstate 80 at Elm Creek exit near Kearney, Nebr. Several camping areas were constructed around the lake.

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, 518 Capitol Federal Building, Topeka, Kans. 66603.

Nebraska Geological Survey, Conservation and Survey Division, University of Nebraska, Lincoln, Nebr. 68508.

SELECTED REFERENCES

Directory of Nebraska Quarries, Pits, and Mines, by R. R. Burchett. Nebraska Geological Survey, Resource Report No. 5, 1971, 73 pp.

Dunes on the Plains. The Sand Hills Region of Nebraska, by C. F. Keech and R. Bentall. Nebraska Geological Survey, Resource Report No. 4, 1971, 18 pp.

Minerals and Gemstones of Nebraska. A Handbook for Students and Collectors, by R. K. Pabian. Nebraska Geological Survey, Educational Circular No. 2, 1971, 80 pp.

Mineral Resource Map of Nebraska, by R. R. Burchett. Nebraska Geological Survey, 1973.

Record in Rock. A Handbook of the Invertebrate Fossils of Nebraska, by R. K. Pabian. Nebraska Geological Survey, Educational Circular No. 1, 1970, 99 pp.

Cenex natural gas processing plant south of Rhame, N. Dak.

NORTH DAKOTA

by
Charles A. Koch

North Dakota is divided into three geographic segments. From east to west, the segments are the flat Red River Valley, the central Glacial Plains, and the Missouri Plateau.

The mineral wealth, namely petroleum and lignite, is found in the Missouri Plateau and the Glacial Plains. Petroleum is the State's leading mineral resource at the present time, but large lignite reserves could very well replace petroleum in the future. Another potential energy source is uranium, which is found as uraniferous lignite in the Missouri Plateau region.

MINES AND PLANTS YOU CAN VISIT

U.S. 85.—During the mid-1960's, a number of companies were experimentally burning lignite to recover the uranium in the 75-mile area from Bowman to just north of Belfield in the southwestern corner of the State (map location 1). Remnants of the burning plants can be seen west of Bowman and at Belfield. 1

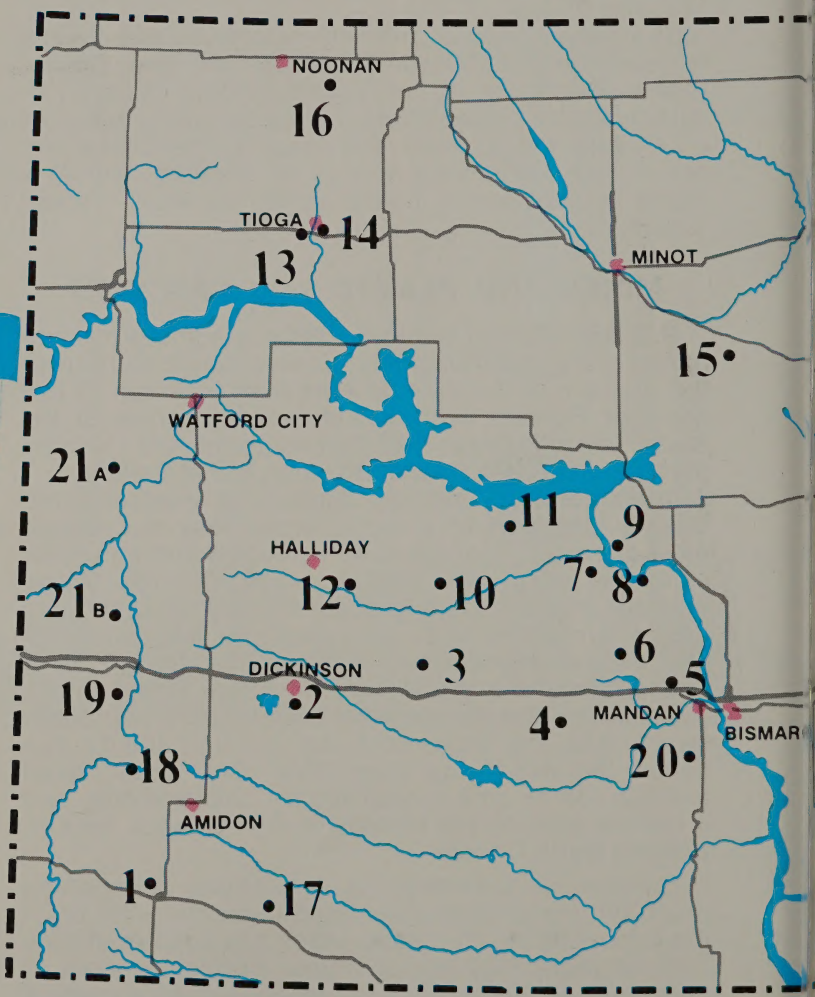
Interstate 94.—The coal deposits of western North Dakota form part of a much larger area that covers most of eastern Montana and extends south into Wyoming and north into Saskatchewan, Canada. These deposits in North Dakota occur in the Fort Union and Lance formations of Tertiary age and are called lignite, a much younger coal than the bituminous coal of Pennsylvania and the Mississippi Valley States.

Many of the coalbeds have been burned out extensively, and the heat from the burning lignite has baked the overlaying clay. This clay when baked forms a red or pink clinker locally called scoria, and it can be seen on the hilltops in the badlands area of western North Dakota.

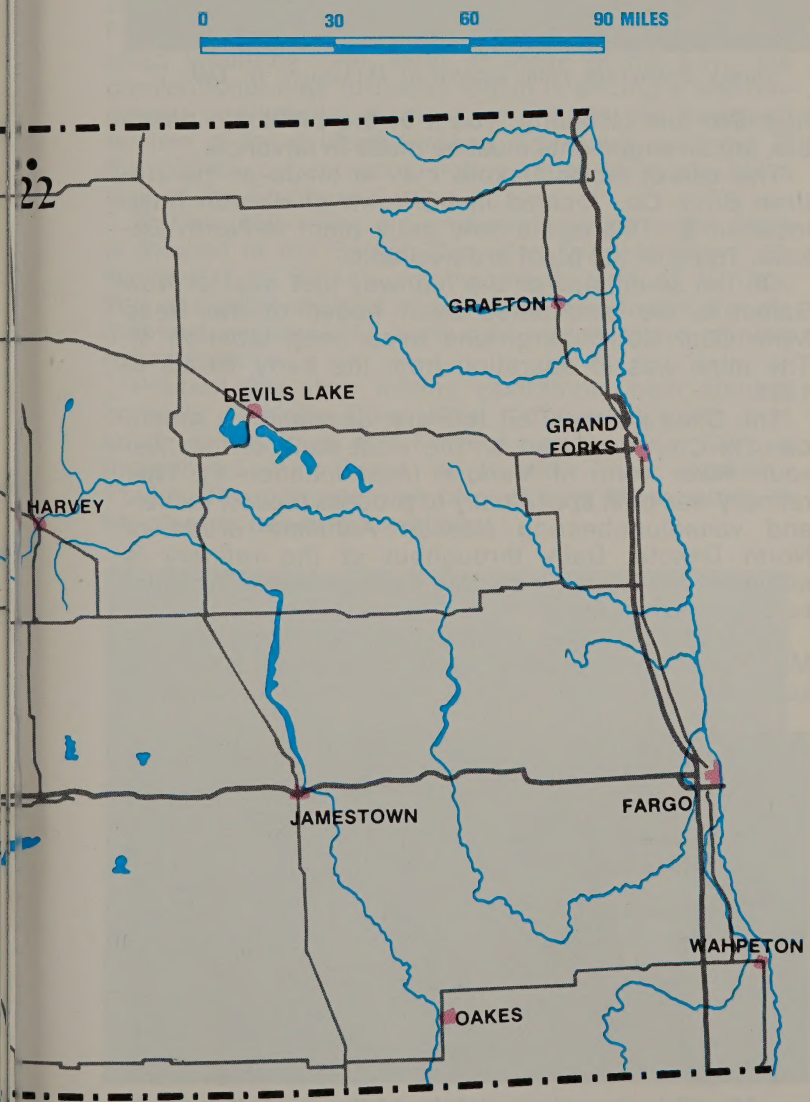
Located at Dickinson is the Husky Briquetting plant, the oldest coal associated industry in the State (map location 2). The plant, which has been operating over 40 years, now manufactures charcoal briquettes for home use barbecuing but in earlier years made a 2

LEGEND

1— Sites of lignite burning to recover uranium
2— Coal briquetting plant
3— Brick manufacturing plant
4— Abandoned deep mine coal company shaft
5— Large oil refinery
6— Electric powerplant and Center lignite mine
7— Glenharold coal mine
8— Electric generating plant
9— Electric generating plant
10— Old underground coal mining area
11— Beulah strip coal mine
12— Indianhead strip coal mine
13— First oil well in North Dakota



14— Beaver Lodge oilfield
15— Velva strip coal mine
16— Noonan strip coal mine
17— Peerless strip coal mine
18— Burning coal vein and columnar cedars
19— Frontier town of Medora
20— Fort Lincoln, Fort McKeen, and Mandan Indian village
21— Theodore Roosevelt National Park (A North), (B South)
22— International Peace Garden



Husky Briquetting plant located at Dickinson, N. Dak.

high-Btu fuel briquette. Tours of the plant are possible, but arrangements must be made in advance.

3 The use of North Dakota clay is made at the Hebron Brick Co., located in the town of Hebron (map location 3). This is the only brick plant in North Dakota. Tours of the plant are available.

4 On the south side of the highway just west of New Salem is the abandoned shaft house of the Deep Mine Coal Co. underground mine (map location 4). The mine was in operation from the early 1920's to 1951.

5 The State's largest oil refinery, operated by American Oil Co., is located on the west bank of the Missouri River north of Mandan (map location 5). This refinery was built specifically to process the low nickel- and vanadium-bearing Nesson Anticline crude of North Dakota. Daily throughput at the refinery is about 48,000 barrels per day. Arrangements for tours can be made at the plant.

N. Dak. 25.—The mine-mouth operation of the MinnKota Power electric generating plant and Baukol-Noonan's Center mine are located about 40 miles

MinnKota powerplant southeast of Center, N. Dak.

northwest of Bismarck (map location 6). Both the mine and plant are new operations; the mine opened in 1970, and the plant, in 1971. 6

The powerplant has the new cyclone furnace designed especially for burning lignite. Although the plant is less than 2 years old, a 400-megawatt addition is being added.

Arrangements for tours of both the plant and mine can be made by contacting MinnKota Power and Baukol Noonan, Inc., respectively, in advance.

N. Dak. 48.—Located about 13 miles north of Center are the mine-mouth operation of the Basin Electric Power Cooperative electric generating plant and Consolidation Coal. Co.'s Glenharold mine and the United Power Association electric power generating plant (map locations 7–9). Both of these plants have the conventional-type furnaces. Basin is adding a 400-megawatt addition to its plant, and it will be designed for use of the cyclone furnace. Tours are available at the plants, but advance notice must be made for a tour of the Glenharold mine. 7 8 9

N. Dak. 200.—The old coal mining area of the State is located in the Beulah-Zap area (map location 10). Northwest of Beulah, on the south side of N. Dak. 200, is a pock-marked or sink-hole area that is the remaining evidence of early-day underground mining operations. 10

Present-day strip mining operations near Beulah consists of Knife River Coal Co.'s mine north and south of the town and North American Coal Corp.'s Indianhead mine west of Beulah (map locations 11–12). The principal use of coal from these mines is for electric power generation. 11 12

Indianhead mine operated by North American Coal Co.

U.S. 2.—Oil was first discovered in North Dakota with the drilling of the Clarence Iverson No. 1, located about 4 miles south and 2 miles west of the junction of U.S. 2 and N. Dak. 40 (map location 13). The discovery well was completed in 1951 and is in the Beaver Lodge field on a geological structure known as the Nesson Anticline (map location 14). Oil wells can be seen on both sides of the highway in the vicinity of the N. Dak. 40 junction.

13

14

U.S. 52.—Located southeast of Velva is Consolidation Coal Co.'s Velva strip mine (map location 15). The mine supplies coal for the powerplant at Voltaire. Many small mines existed in this area during the early 1900's.

15

Glenharold coal mine operated by Consolidation Coal Co.

N. Dak. 5.—In northwestern North Dakota near the town of Columbus, Baukol-Noonan, Inc., has a small lignite strip mine (map location 16). This is the only strip mine operating in this portion of the State.

16

U.S. 12.—Because of the increased demand for lignite, Knife River Coal Co. is constructing a new mining operation 20 miles east of Bowman in southwestern North Dakota (map location 17). The new mine is at the present site of their small strip mining operation. Coal from the mine will be hauled by unit train to the Big Stone Plant (electric power generation) in northeastern South Dakota.

17

GHOST TOWNS AND HISTORICAL SITES

About 10 miles south of Belfield is a road on the west side of U.S. 85 that leads to one of two burning coal veins in the State (map location 18). The interesting point of this site is the unique growth of cedars. These trees are growing in a columnar shape because of the fumes from the burning vein.

18

Located in the badlands of western North Dakota on Interstate 94 is the restored frontier town of Medora (map location 19). This town, which was the home of former President Theodore Roosevelt, was restored by a North Dakota resident, Harold Schafer, president of Gold Seal Co. The town is now the center of tourist attractions in the badlands area. 19

Also along Interstate 94, 4 miles south of Mandan, are the cavalry and infantry posts of Fort Lincoln, Fort McKeen, and the site of a Mandan Indian village (map location 20). General George Armstrong Custer began his fatal march to the Little Big Horn from Fort Lincoln. 20

The rugged beauty of the badlands of western North Dakota can best be seen on a drive through the North and South Units of Theodore Roosevelt National Memorial Park (map location 21). The South Unit entrance is at Medora on Interstate 94 and the North Unit entrance is on U.S. 85, 50 miles north of the South Unit. 21

As a symbol of peace between the United States and Canada, the state of North Dakota and the province of Manitoba constructed the International Peace Garden (map location 22). The Peace Garden is located at the Canadian border on U.S. 281. 22

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, 219 North Seventh Street, Suite 10, Bismarck, N. Dak. 58501.

Greater North Dakota Association, 711 Second Avenue North, Fargo, N. Dak. 58102.

State Geologist, North Dakota Geological Survey, University Station, Grand Forks, N. Dak. 58202.

SELECTED REFERENCES

Facts About North Dakota. Business and Industrial Development Department, Bismarck, N. Dak., 1971, 32 pp.

Mineral Resources of North Dakota, by U.S. Department of the Interior and the North Dakota Geological Survey. North Dakota Geological Survey, Grand Forks, N. Dak., 1973, 252 pp.

Big Muskie, the world's largest dragline, cost $20 million to build and has a reach the length of a football field. It weighs 27 million pounds, and its 220-cubic-yard bucket can move 325 tons of overburden at a single pass. Big Muskie is shown operating at the Muskingum mine near Cumberland, Ohio. (Courtesy of Ohio Power Co.)

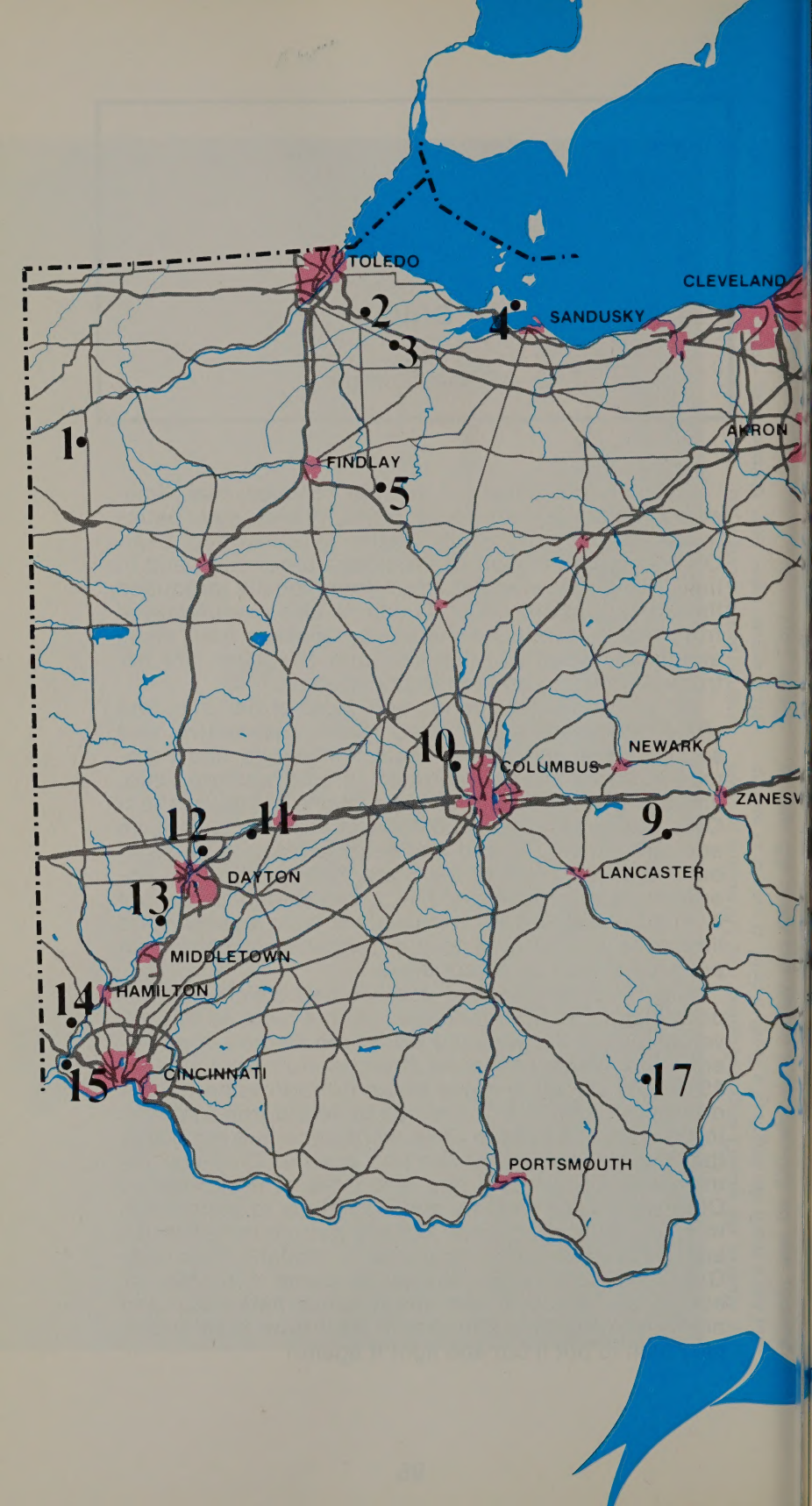
OHIO

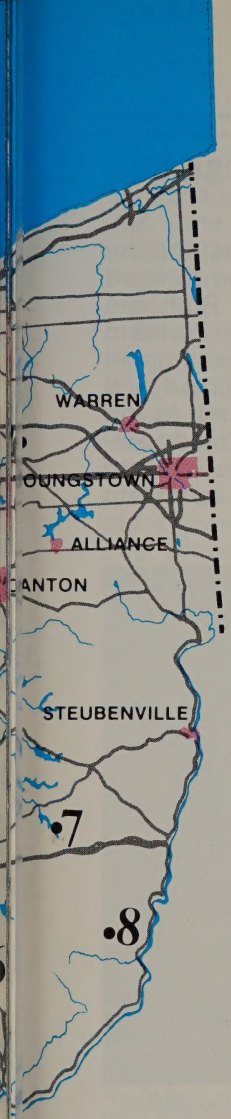
by
William S. Miska

The mineral industries in Ohio produce coal, limestone, dolomite, sandstone, sand, gravel, salt, petroleum, natural gas, clays, shale, gypsum, and peat. Ohio leads the Nation in sandstone production and in lime, which is manufactured from locally produced limestone and dolomite. Cement is also manufactured from locally produced materials, whereas iron, steel, aluminum, beryllium, titanium, and zirconium are extracted from imported mineral materials.

All of Ohio's coal mines and most of her clay and shale operations are located in the east-central and southeastern part of the State. Limestone and dolomite quarries are concentrated in northwestern Ohio, and most of the lime producing plants are in northern Ohio along with the sandstone quarries and gypsum and salt mines. Oil and gas fields are found throughout the eastern half of the State. Sand and gravel operations are concentrated in a broad belt extending from southwestern to northeastern Ohio between the limestone quarry area to the northwest and the coal producing area to the southeast.

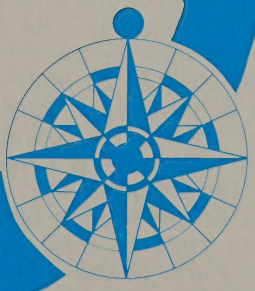
Mineral extraction and use has had a rich and colorful history in Ohio including such events as the development of the Hanging Rock Iron Region in southern Ohio, which produced charcoal iron from 1818 to 1916, and the oil and gas boom in northwestern Ohio during the 1880's. The remains of 46 old iron furnaces in the hills of southern Ohio were once hulking giants that produced much of the iron used in Civil War armaments. The oil and gas resources of northwestern Ohio were used lavishly and wastefully to exhaustion in a relatively short time, but the petroleum refineries and glass manufacturing plants it brought in remain. Gas once sold in Findlay at 15 cents a month for each grate or stove, and street lamps flared day and night because "it is cheaper to let it burn than to employ men to put it out and light it again."


TOLEDO
CLEVELAND
SANDUSKY
AKRON
FINDLAY
NEWARK
COLUMBUS
ZANESV
DAYTON
LANCASTER
MIDDLETOWN
HAMILTON
CINCINNATI
PORTSMOUTH
1
2
3
4
5
9
10
11
12
13
14
15
17



LEGEND

1— Limestone quarries
2— Limestone quarries
3— Dolomite quarry
4— Marblehead quarry
5— Dolomite quarry
6— Sand and gravel dredge
7— Surface coal mining
8— Underground coal mines
9— Limestone crushing plant
10— Limestone quarries
11— Sand and gravel pits
12— Sand and gravel pits
13— Sand and gravel pits
14— Sand and gravel pit
15— Petroleum refining plant
16— Large strip coal mine
17— Reconstructed charcoal iron furnace



0 20 40 60 MILES

MINES AND PLANTS YOU CAN SEE FROM THE HIGHWAY

1 **U.S. 127.**—Across open fields to the west of the highway are the facilities of General Portland Cement Co. and the France Co. (map location 1). Both are quarrying and crushing limestone. General Portland Cement Co. uses the stone to produce cement, and France Co. markets its stone for agricultural use and as a construction aggregate. For a closer look at the cement manufacturing plant and the quarrying operations, proceed west on Crane Township Road 176 to Crane Township Road 97 then proceed north on Crane Township Road 97.

Ohio Lime Co. lime manufacturing plant located at the southeast edge of Woodville, Ohio.

2 **U.S. 20.**—Several quarry operations are located at Woodville (map location 2). Ohio Lime Co. uses dolomite to produce lime at its plant located on the east side of Woodville. The quarry is hidden from view, but a close look at the lime plant is possible by turning south off U.S. 20 onto Anderson Road. On the north-side of Woodville, about one-half mile off U.S. 20 on Lime Street, are plants and quarries belonging to Woodville Lime & Chemical Co. and Standard Lime and Refractories Co., Div. of Martin Marietta Corp. Lime Street passes alongside the plants, which have rotary kilns to burn the dolomite and convert it to lime. Parts of the quarry pits and other views of the plants can also be seen from Woodville Cemetery, which has its entrance on Lime Street between the two operations.

Ohio 300.—About one-half mile west of Ohio 300 on Sandusky County Road 85 are the dolomite quarry and lime producing plant operated by Pfizer, Inc. (map location 3). Sandusky County Road 85 offers the best view of a quarry in the Gibsonburg-Woodville area. 3

Ohio 163.—Ohio 163 west of Marblehead passes along the northside of Marblehead quarry operated by Standard Slag Co. (map location 4). The sprawling limestone quarry occupies most of the eastern tip of this peninsula jutting into Lake Erie, and it is so vast that no one ground level vantage point offers a complete view of the area quarried. The Marblehead Cemetery grounds, just west of Marblehead, is one of the best places from which to view active quarry operations. Nearby a conveyor belt passes over Ohio 163 transporting crushed limestone to a lake vessel loading dock. Large lake vessels are a common site at the limestone loading dock. 4

U.S. 23.—A dolomite quarry, a large stone crushing plant, and a lime manufacturing plant are operated by National Lime & Stone Co. on the north side of Carey. Turn east off U.S. 23 onto Wyandot County Road 16 and proceed east across intersection with Wyandot County Road 99 (about 0.7 mile east of U.S. 23). From this intersection, Wyandot County Road 16 extends along the north side of National's dolomite quarry for a distance of 1 mile offering many fine views of active quarry operations (map location 5). Wyandot County Road 99, south from the intersection with Wyandot County Road 16, passes between National's lime plant and its stone crushing plant. The stone crushing facilities of another dolomite producer, Wyandot Dolomite Inc., is located on Wyandot County Road 99 a short distance north of its intersection with Wyandot County Road 16. 5

Ohio 43.—The sand and gravel dredge and processing plant operated by Hugo Sand Co. is 2 miles north of Kent (map location 6). 6

Ohio 9.—A drive along Ohio 9 between St. Clairsville and Cadiz, a distance of 17 miles, offers many views of past and present surface coal mining and land reclamation activities (map location 7). One of the principal operators in the area is the Central Div. (formerly Hanna Coal Co.) of Consolidation Coal Co. The firm also operates the Georgetown preparation plant, a large coal cleaning facility that can be seen from Ohio 9 or U.S. 250 a short distance south of Cadiz. 7

Ohio 148, Ohio 7.—The surface facilities of five underground mines can be seen driving north on Ohio 7 from Clarington to Powhatan Point, about 7 miles, and then east on Ohio 148 for a distance of about 15 miles (map location 8). The entrance to one of the 8

Coal storage silo and train loading facilities for the Allison mine 5 miles west of Armstrong Mills, Ohio, on Ohio 148.

largest underground coal mines in Ohio, which is named Powhatan No. 1 and operated by North American Coal Corp., is located on Ohio 7 at the south edge of Powhatan Point. Another North American operation, which serves the Powhatan No. 4 mine with storage facilities, a modern coal cleaning plant, and an enclosed conveyor belt over Ohio 7, can be seen 2 miles north of Clarington.

On Ohio 148, 7 miles east of Ohio 7, is Oglebay Norton Co.'s Norton No. 3 mine. Four miles west of Armstrong Mills on Ohio 148 is Nacco Mining Co.'s mine No. 6. This facility has a conveyor passing over the highway. Five miles west of Armstrong Mills is the coal storage silo and train loading facilities for the Allison mine operated by the Youghiogheny & Ohio Coal Co. All five of these underground mines are working the same coalbed, the Pittsburgh (No. 8), which has a uniform average thickness of about 60 inches.

Ohio 345.—Just south of U.S. 22 at East Fultonham is a limestone crushing plant operated by Chesterhill Stone Co. (map location 9).

9

Interstate 270, Exit 6.—Marble Cliff Quarries Co. has quarried and crushed limestone at several locations just west of the Sciota River along McKinley Avenue on the west side of Columbus (map location 10). Active quarry operations can be viewed on McKinley Avenue just south of Roberts Road. Another view of the operation is possible from the James Thomas Park, which has its entrance just north of the Roberts

10

Road intersection. Proceed east from Interstate 270, Exit 6, 1 mile on Roberts Road to McKinley Avenue.

Interstate 70, Ohio 4.—The sand and gravel pit and processing plant operated by Enon Sand & Gravel Co. is north off Interstate 70 at the Enon exit or Exit 16. The operation is located adjacent to Ohio 4 just east of the intersection of Ohio 4 and Interstate 70 (map location 11). 11

Ohio 4.—In northeast Dayton is the large sand and gravel operation belonging to American Aggregates Corp. (map location 12). The best view of processing plant and pits is from the northbound lane of Ohio 4, north of the Stanley Avenue-Findlay Street exit. Part of the mined land has been reclaimed as a lake that has been found ideally suited for speedboat racing. 12

Ohio 4, Ohio 123.—A sand and gravel processing plant and ready mix cement plant operated by Weide Sand & Gravel, Inc., is located at Germantown (map location 13). A somewhat larger sand and gravel processing plant belonging to Moraine Materials Co. is located on Ohio 123, at Carlisle, 6 miles southeast of Ohio 4. 13

Ohio 128.—Sand and gravel is produced by the Barret Sand and Gravel Co. from a pit 4 miles north of Interstate 70 (map location 14). 14

Ohio 128, U.S. 50.—On Ohio 128, 0.8 mile north of U.S. 50, is a large petroleum refinery and petroleum tank farm operated by the Gulf Oil Corp. (map location 15). Just south of the refinery on Ohio 128 is a sand and gravel processing plant belonging to Ohio Gravel Co. 15

MINES YOU CAN VISIT

Ohio 284.—The largest mobile land machine in the world, a 27,000,000-pound dragline, is operated by the Central Ohio Coal Co., a subsidiary of Ohio Power Co., at the Muskingum mine near Cumberland (map location 16). Dubbed Big Muskie, the mammoth machine removes overburden in 325-ton or 220-cubic-yard bites to expose coalbeds lying at depths up to 160 feet. Big Muskie ranges over a wide area and is not always visible from public highways. When feasible, Ohio Power Co. provides an observation shelter from which visitors are welcome to watch Big Muskie at work. Visitors should inquire locally for the whereabouts of Big Muskie and the availability of observation points. 16

GHOST TOWNS AND HISTORICAL SITES

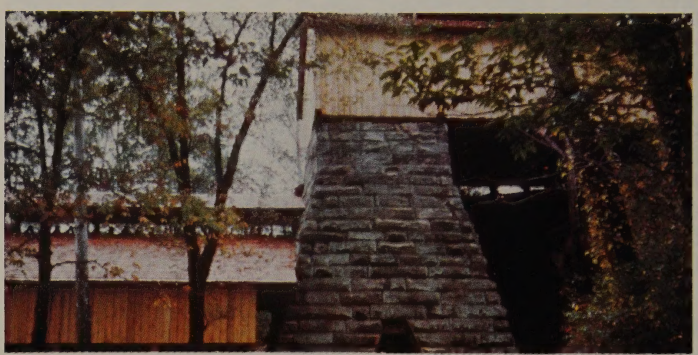
Ohio 124.—The Buckeye Furnace State Memorial, near Wellston in the center of the famous Hanging

Rock iron region, enables visitors to see what was once commonplace in southern Ohio—a charcoal iron furnace. Buckeye furnace, in blast from 1851 to 1894, is the only charcoal iron furnace in the Hanging Rock region to be reconstructed, and thus it is representative of all of the 70 furnaces that made the region one of the Nation's leading iron producers during the Civil War (map location 17). The region produced much of the charcoal iron used in Civil War armaments including the Swamp Angel, a famous cannon used in the siege of Charleston Harbor, and the iron used to sheathe the famous Union ironclad, Monitor.

17

The Hanging Rock region is a 25- to 30-mile-wide belt that extends from Logan in Hocking County, Ohio, to Mt. Savage in Carter County, Ky. The name "Hanging Rock" is taken from a high sandstone bluff on the Ohio River. Iron was produced in the region from 1818 to 1916. The first furnace to be built in the Ohio portion of the Hanging Rock region was Union furnace built in Lawrence County in 1826. In all, 46 furnaces were built on the Ohio side of the river and about 24 on the Kentucky side.

The Hanging Rock region did not become an iron producing region strictly by chance. The area was adequately endowed with all the necessary raw materials including numerous deposits of native iron ore and limestone and hundreds of square miles of virgin timber to produce charcoal as well as an abundance of sandstone to build and line the massive stone furnace stacks. The low-grade native iron ores were 4 to 18 inches in thickness and were strip mined by men using only shovels, picks, wheelbarrows, and perhaps a horse-drawn scraper. Profitable mining permitted the removal of 1 foot of dirt for 1 inch of ore. When the ore became too deep, usually 10 to 12 feet, the ore diggers would merely move to the next hill. Charcoal furnace buffs can see remnants of these ore diggings snaking for miles along hill slopes.



Buckeye furnace, a reconstructed charcoal iron furnace, in Jackson County, Ohio. (Courtesy of the Ohio Historical Society.)

The furnace itself was constructed of massive hand-hewn sandstone blocks and stood between 35 to 40 feet high. Iron ore, limestone, and charcoal were placed in the furnace at the top, and molten iron and a glassy waste product called slag were drawn off at the bottom. There were many wooden storage and service buildings attached to and surrounding the furnace. In the vicinity of each furnace, a community of several hundred people would arise. Included were laborers, teamsters, ore diggers, blacksmiths, carpenters, charcoal burners, storekeepers, bookkeepers, and the furnace manager or owner. The towns themselves were complete with a general store, church, school, graveyard, and place of employment—the furnace. Nearly all of the buildings and all but 17 furnaces have completely disappeared. What remains is still worth seeing such as company store buildings, several furnace stacks in fair to good condition, and of course, the reconstructed Buckeye furnace.

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, Seventh and College Streets, Bloomington, Ind. 47401.

Ohio Department of Industrial Relations, Division of Mines, 220 Parsons Avenue, Columbus, Ohio 43215.

Ohio Department of Natural Resources, Division of Geological Survey, 1930 Belcher Drive, Columbus, Ohio 43224.

Ohio Department of Natural Resources, Division of Reclamation, 1930 Belcher Drive, Columbus, Ohio 43224.

The Ohio Historical Society, Ohio Historical Center, Columbus, Ohio 43211.

SELECTED REFERENCES

A Century and a Half of Ohio's Minerals, by Division of Geological Survey Staff. Ohio Geological Survey Information Circular 24, 1959, 66 pp.

Coal Resources of Ohio, by R. A. Brant and R. M. DeLong. Ohio Geological Survey Bulletin 58, 1960, 245 pp.

Division of Mines Report. Ohio Department of Industrial Relations, annual publication.

The Hanging Rock Iron Region of Ohio, by H. R. Collins and D. K. Webb, Jr. The Ohio Historical Society, 1967, map.

List of Publications. Ohio Department of Natural Resources, Division of Geological Survey, 1972, 43 pp.

Natural Resources of Ohio, by U.S. Department of the Interior. U.S. Government Printing Office, Washington, D.C., 1963, 56 pp.

Coal gasification plant at Rapid City, S. Dak.

SOUTH DAKOTA

by
James H. Aase

From the land of the famous Sioux or Dacotah Indian, "How Kola!" meaning Hello Friend . . . and with it an invitation to visit and enjoy many of the geologic splendors, mining operations, and mineral occurrences you will find in South Dakota.

The most notable geological formations are the Black Hills and the Badlands. The Black Hills, reaching an elevation of 7,242 feet, are the highest mountains east of the Rockies and contain most of the hard rock mining operations in the State. The Badlands, caused by centuries of erosion, are beautifully colored cliffs, ridges, and spires; once a prehistoric swamp, this area is now considered one of the richest fossil beds in the world.

Rose quartz, the official State mineral, first discovered near the city of Custer in the late 1800's, is currently mined in the southern Black Hills. The Fairburn agate, the official State gem stone, is a semiprecious stone occurring throughout a large belt extending from Farmingdale, S. Dak., to Orella, Nebr.

Although South Dakota cannot be considered a heavyweight from the standpoint of the total dollar value of the minerals it produces, ranking 42d among the 50 States, it does boast having the largest producing gold mine in the Western Hemisphere, which accounts for approximately 30 percent of all gold produced annually in the United States. Other important minerals found in the State are oil, gas, coal, uranium, feldspar, beryllium, and bentonite.

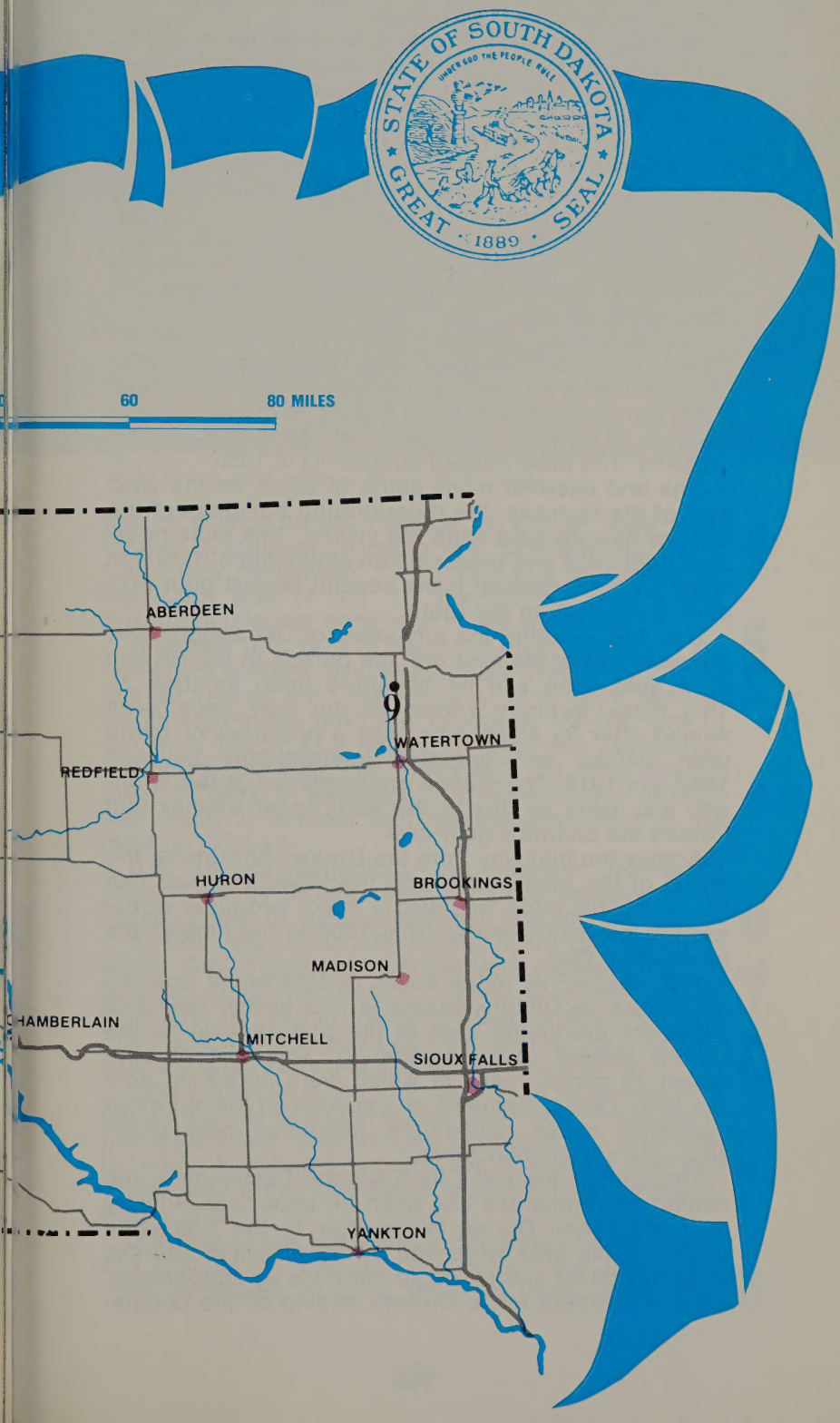
MINES AND PLANTS YOU CAN SEE FROM THE HIGHWAY

U.S. 85.—With the city limits of Lead on the south side of Main Street (U.S. 85), the surface plant and headframes of the two main shafts of the famous Homestake gold mine can be observed (map location 1). Almost continuously since July 1878, when construction of the first stamp mill was completed near this site, the mine has produced in excess of 31 mil- 1

LEGEND

1—Homestake gold mine
2—Inactive Broken Boot gold mine
3—Galena lead-silver district
4—Feldspar processing plant
5—Historic Holy Terror gold mine
6—Uranium ore processing plant
7—Limestone quarries
8—Bentonite processing mill
9—Granite quarries

0


STATE OF SOUTH DAKOTA
UNDER GOD THE PEOPLE RULE
GREAT SEAL
1889
60
80 MILES
ABERDEEN
WATERTOWN
REDFIELD
HURON
BROOKINGS
MADISON
CHAMBERLAIN
MITCHELL
SIOUX FALLS
YANKTON

lion ounces of gold and 7 million ounces of silver valued at approximately $1 billion.

One-half mile west of the Homestake mine, on the north side of Main Street, an area known as the open cut is visible. This manmade canyon, nearly a mile in length, is the result of open pit mining operations conducted prior to 1945 by Homestake Mining Co. Approximately 48 million tons of rock have been removed of which 15 percent was gold bearing ore. It was at this site in April 1876, that the discovery of the Homestake ore body was made by Fred and Moses Manuel. They named their claim "Homestake," and the mining camp that soon leaped to life took the name of Lead City.

One mile south of Lead and 4 miles west on the county road to Trojan and the Terry Peak ski area, the remaining surface structures of Bald Mountain mine can be observed. Early history of the mine dates back to 1877 when gold was first discovered on the property. The mine ceased operations in 1955.

One and one-half miles south of Lead, on the west side of the highway, the deteriorating buildings of the Golden Reward gold mine are visible. This mine operated until 1918 and produced an estimated $21 million worth of gold, ranking it the second largest gold producing property in the State.

U.S. 14A.—Within the city limits of Deadwood, near the west end of Main Street, the portals to the Broken Boot gold mine can be observed (map location 2). This mine, formerly known as the Olaf Seim mine named after its discoverer, was a producer of pyrite (iron sulfide) and operated intermittently between 1890 and 1918. The sulfide ore produced at this property was used as flux in the early local smelter that treated the district's gold ores.

2

Across the highway from the Broken Boot mine, the portal of the Montezuma and the Whizzers mine can be seen. This mine was also a major producer of pyrite for the local smelter from 1900 to the time of the First World War.

U.S. 385.—Five miles south of Deadwood and 3.5 miles east on County Road 534 is a former lead and silver ore producing area of the State known as the Galena district (map location 3). This district contained 19 mines, many of which were active up until the early 1900's. Remains of a number of these former operating mines, settlement locations, now ghost sites, are still recognizable.

3

Throughout the Hill City-Keystone-Custer area, the mining of pegmatites has been an important industry over the years. During World War II, the pegmatite mines in this area were one of the principal sources of such critical and strategic minerals as spodumene, beryl, and sheet mica. Current mining of the pegma-

Holy Terror gold mine at Keystone, S. Dak.

tites is principally for feldspar. In Custer (map location 4) a feldspar grinding mill operated by Pacer Corp. may be viewed. Two miles east of Custer, on the south side of U.S. 16, the Spring, Agnew, and Shamrock feldspar pegmatite mines are visible. 4

Alternate U.S. 16.—At Keystone (map location 5) the remaining surface structures of the Holy Terror mine can be viewed from the highway. This mine, famous for its high-grade gold ore, produced 150,000 tons of ore from which $1.3 million of gold was recovered. During its operating life, 1894–1902, the mine was the main industry of Keystone. An unsuccessful attempt was made to dewater and resume operations of the mine in 1939–41. 5

U.S. 18.—In Edgemont, the uranium processing plant of Mines Development, Inc., can be seen along the south side of the highway (map location 6). 6

S. Dak. 79.—Adjacent to the north city limits of Rapid City limestone quarries are visible from the highway (map location 7). These quarries provide limestone for use in the South Dakota State Cement Plant and the lime plant of Pete Lien & Sons located near the quarry site and visible from the highway. 7

Also visible from the highway in the southeast section of the city is a coal-lignite gasification pilot plant. This pilot plant, operated by Consolidation Coal Co., is testing a technical process for converting coal and Lignite into a gas of pipeline quality similar to that of natural gas.

U.S. 212.—The bentonite processing mill of American Colloid Co. can be viewed from the highway 2 miles northwest of Belle Fourche (map location 8). 8

The bentonite processed at this mill comes principally from pits located and visible from the highway over the State line in Wyoming. Bentonite is a special clay used extensively in oil well drilling muds, foundry sands, iron ore pelletizing, and other uses because of its unique physical property of swelling when wetted with water.

U.S. 12.—By taking a short detour off the highway at Milbank and proceeding 6 miles east and 1 mile south on County Road 10, the finishing plant and quarry site of Dakota Granite Co. can be viewed (map location 9). The dark mahogany colored stone quarried here, and by other companies in the immediate area, is used principally for monuments and polished panels.

9

MINES, PLANTS, AND MUSEUMS YOU CAN VISIT

U.S. 85.—Free guided surface tours of the Homestake gold mine at Lead are available to the public during the months of May through September (map location 1).

1

U.S. 14A.—Underground mine tours of the Broken Boot gold mine in Deadwood are available to the public. An admission fee is charged by the Deadwood Chamber of Commerce, operators of this attraction (map location 2).

2

The Adam Museum on Deadwood Street contains many mineral items and antique mining equipment

Surface plant of Homestake gold mine at Lead, S. Dak. (Courtesy of Homestake Mining Co.)

used in the early mining days of the area (map location 2). 2

S. Dak. 79.—The Geological and Mineralogical Museum, located on the campus of the South Dakota School of Mines and Technology in Rapid City, has an outstanding mineral and fossil collection available for public viewing (map location 7). 7

Tours through the coal-lignite gasification pilot plant in Rapid City are available between 8:00 and 11:00 a.m. on the first and third Fridays of each month. Arrangements should be made well in advance (map location 7). 7

U.S. 12, County Road 10.—Operators of the granite quarries and finishing plants near Milbank do not conduct tours through their facilities. However, visitors are welcome to visit the quarry sites and can look down into the pits (map location 9). 9

FOR MORE INFORMATION WRITE OR VISIT

Black Hills, Badlands, and Lakes Association, P.O. Box 539, Sturgis, S. Dak. 57785.

Chamber of Commerce, 603 West Main Street, Lead, S. Dak. 57754.

Chamber of Commerce, 428½ St. Joseph Street, Rapid City, S. Dak. 57701.

Federal Bureau of Mines Liaison Office, Federal Building—U.S. Court House, 515 Ninth Street, Rapid City, S. Dak. 57701.

South Dakota School of Mines and Technology, 500 East St. Joseph Street, Rapid City, S. Dak. 57701.

State Geological Survey, Science Center, University, Vermillion, S. Dak. 57069.

SELECTED REFERENCES

Black Hills Mineral Atlas, South Dakota, Part I, Northern Black Hills, Bureau of Mines Information Circular 7688, 1954, 123 pp.

Black Hills Mineral Atlas, South Dakota, Part II, Southern Black Hills. Bureau of Mines Information Circular 7707, 1955, 208 pp.

A Guide to Black Hills Ghost Mines, by M. Fielder, North Plains Press, Aberdeen, S. Dak. 1972, 240 pp.

Mineralogy of the Black Hills, by Roberts and Rapp. South Dakota School of Mines and Technology, Rapid City, S. Dak., 1965.

Prospector, Cowhand, and Sodbuster. V. 11 in the National Survey of Historic Sites and Buildings, edited by R. G. Ferris. U.S. Department of the Interior, 1967, 320 pp.

The Treasure of the Homestake Gold, by M. Fielder. North Plains Press, Aberdeen, S. Dak., 1970, 478 pp.

Montello Granite Co. dimension stone quarry in Marquette County. (Courtesy of Wisconsin Geological and Natural History Survey.)

WISCONSIN

by
Wesley A. Grosh

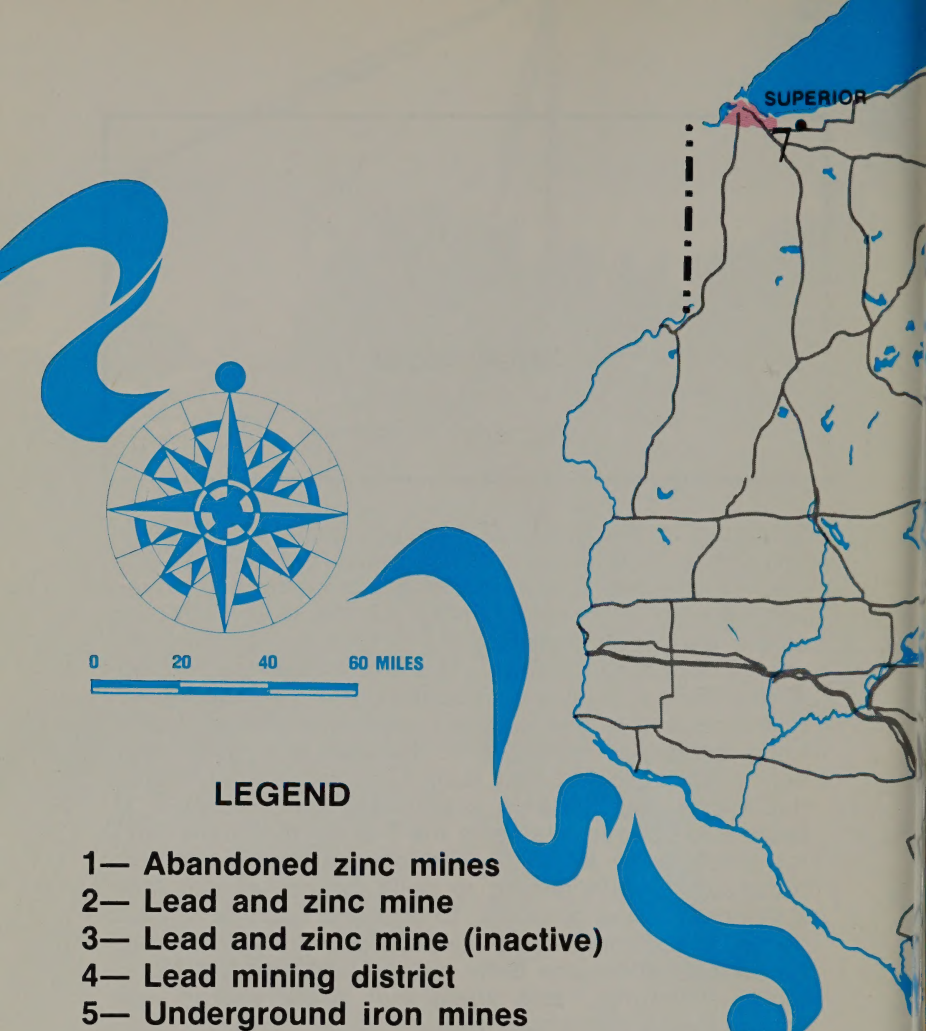
Mining in the Upper Mississippi Valley dates back 285 years. Southwestern Wisconsin is a part of this district and has continuously recorded lead production for over 175 years. Mining was the primary factor in the early settlement of the area long before Wisconsin was made a State. The significance of mining in the State's history is recognized in the State seal. In the shield is the crossed pick and shovel, traditional symbol of mining. Also depicted is a miner with very early style hat and lamp. The first mineral production in the State is symbolized by stacked pig lead. The badger relates to the State's nickname dating back prior to 1830. The miners who were too preoccupied with mining to build houses moved into abandoned mine openings to live and became known as "badgers" because of this style of life. Much can be learned about the early mining lore from artifacts, tools, structures, and equipment preserved in the southwestern Wisconsin area.

The State is also known for its iron ore production that, except for a period of 3 years from 1966 through 1968, has been continuous since 1849. Today the greatest mineral production in terms of value is represented by construction aggregates, iron ore, lime, zinc, and lead.

The principal interesting mining features in the State may roughly be divided into three general areas, each with a different principal mineral or commodity being mined. In the southwestern part of the State is the lead-zinc district with zinc mines still operating and historical mines open to visitors.

The greatest iron mining area was in the northern part of the State; however, there are no active mines in that area at present. The only operating iron mine is in a remote area near the west-central part of the State, not visible from main-traveled roads, and the company has no provisions for visitors.

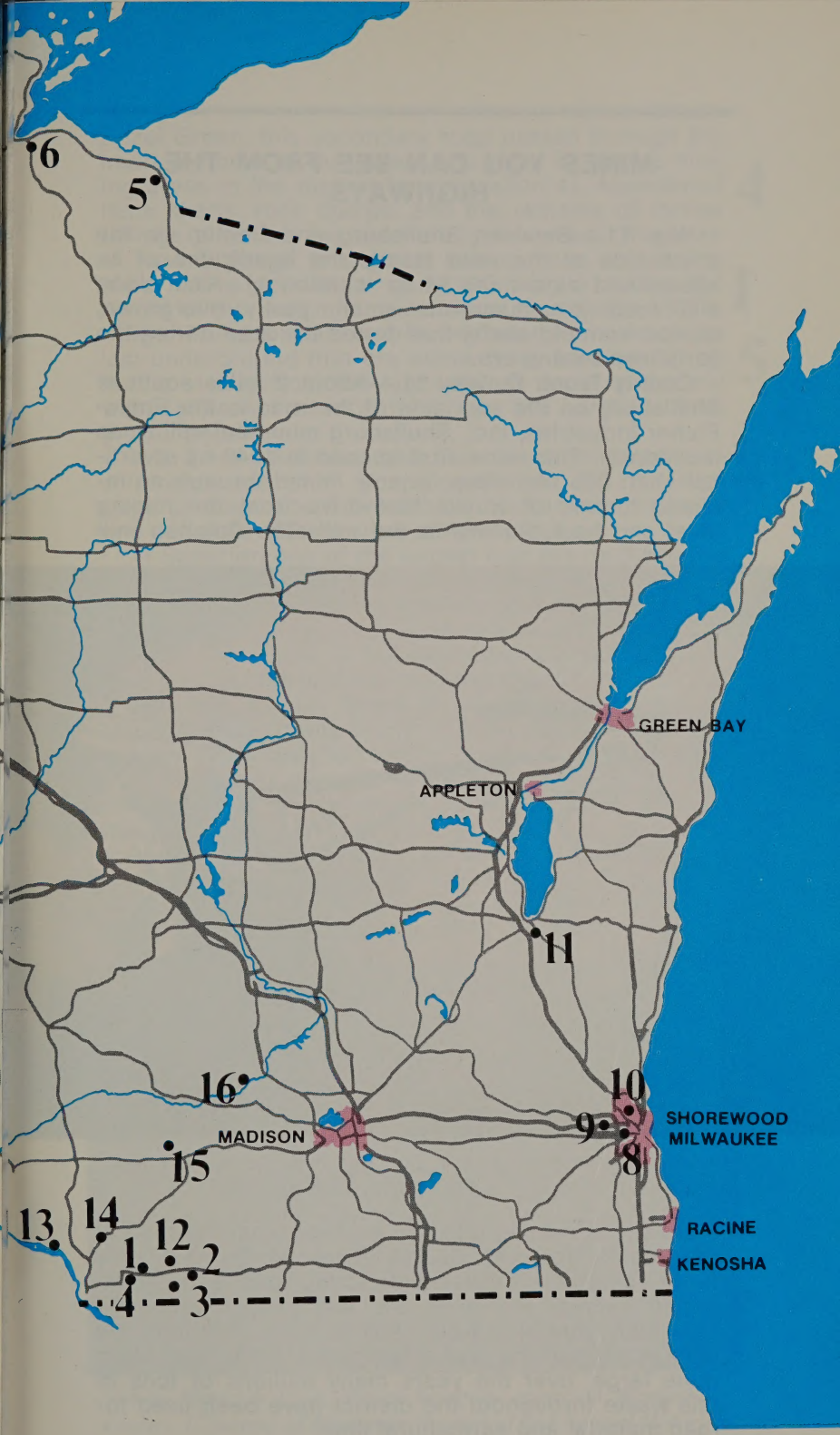
Most construction materials are mined near large population centers in the eastern and southeastern portion of the State.



LEGEND

1— Abandoned zinc mines
2— Lead and zinc mine
3— Lead and zinc mine (inactive)
4— Lead mining district
5— Underground iron mines (inactive)
6— Iron ore docks
7— Iron ore docks
8— Limestone quarry
9— Limestone quarry
10— Limestone quarries
11— Limestone quarries
12— Reconstructed lead mine
13— Underground lead mine (inactive)
14— Platteville Mining Museum
15— Ancient lead smelting furnace
16— Historic shot manufacturing shaft

GREAT SEAL OF THE STATE OF WISCONSIN
FORWARD


6
5
GREEN BAY
APPLETON
11
16
10
9
8
SHOREWOOD
MILWAUKEE
MADISON
15
13
14
1
12
2
RACINE
KENOSHA
4
3

MINES YOU CAN SEE FROM THE HIGHWAYS

Wis. 11.—Between Shullsburg and Benton on the south side of the road stands the headframe of an abandoned zinc mine (map location 1). Also along this road are numerous small, partly overgrown, dumps from old shafts that dotted the area during the early lead mining era.

1

County Trunk O, Wis. 11.—About 2 miles south of Shullsburg on the east side of the road is the Eagle-Picher Industries, Inc., Shullsburg mine and mill (map location 2). This mine, first opened in 1949 by a vertical shaft 355 feet deep, is now mined through an inclined tunnel for trucks that drive from the mining level and haul the ore to the mill. The flotation mill

2

Jumbo drill operating at a zinc-lead mine in southwestern Wisconsin. (Courtesy of Eagle-Picher Industries, Inc.)

and tailings (waste) pile can be seen from the road at the intersection with County Trunk W. One-half mile farther south on the west side of the road is the abandoned Vinegar Hill mine and mill (map location 3). This plant operated from 1950 to 1970. Although the tailings piles of the recent operating mines may seem quite large, over the years many millions of tons of this waste throughout the district have been used for road material and agricultural lime.

3

County Trunk W, Wis. 11.—From County Trunk O to

Hazel Green, this secondary road passes through the heart of some of the oldest and most extensive mining areas in the district (map location 4). Abandoned mine shafts, rock dumps, and the remains of former tailings piles can be seen along this road. The town of New Diggings is a ghost mining town reputed to have had a population of 10,000 people during the height of the lead mining period of the middle 1800's. 4

Wis. 77.—Montreal and Hurley were the sites of the last underground iron ore mines (map location 5). All that is visible from the highway are some of the old waste piles and a few of the shops and buildings from these operations. 5

U.S. 2.—At Ashland, one iron ore dock remains—shipments are small (map location 6). On the east edge of town, about two blocks north of the highway one can get a closeup view of these docks. 6

At Superior, one of the largest iron ore docks in the Nation can be seen from the highway (map location 7). Trainloads of iron ore are hauled out on the docks and dumped into bins from which the ships are loaded. The height of the docks permits gravity loading from the cars to the bins to the ships. 7

Wis. 164, County Trunk K.—On the west edge of Milwaukee at County Trunk K, is the Sussex Quarry of Vulcan Materials Co. where crushed stone is produced (map location 8). From the road one can see the extensive crushing and screening plant used in the production of limestone. 8

About one-half mile west of 164 on County Trunk K is the Halquist Lannon Stone Co. quarry (map location 9). Crushed stone as well as dimension stone are produced by this company. From the road, one can 9

Vulcan Materials Corp. Sussex limestone quarry in Waukesha County. (Courtesy of Wisconsin Geological and Natural History Survey.)

Fond du Lac Stone Co., Inc., limestone quarry south of Fond du Lac, Wis.

see some of the types of dimension stone in the company's storage yard and some of the crushing plant in the quarry.

Wis. 74.—On the north side of the road, at the west edge of Lannon, one can see an abandoned quarry where the famed "Lannon" stone was produced (map location 10). This limestone formation is a layered rock and tends to split along bedding planes in thin layers of 4 to 6 inches thick. The stone was used for facing buildings because it could be broken to roughly rectangular blocks. It was a labor intense industry, characterized by many small operators hewing and trimming the stone by hand methods. Because of the high labor costs, most of the quarries are now idle.

10

Wis. 175.—South of Fond du Lac, about 3.5 miles south of the intersection with U.S. 41, the Panetti Stone Co. has a plant and quarry on the east side of the road where dimension and crushed stone are produced (map location 11). The plant and part of the quarry are visible from the road. A quarter of a mile farther south on the west side of the road is the quarry of the Fond du Lac Stone Co. where similar products are produced.

11

MINES YOU CAN VISIT

Wis. 11.—At Shullsburg, the Badger mine, in operation about 1827, has been rehabilitated so one can see about one-half mile of old workings restored to simulate the pioneer miners working conditions (map location 12). The entrance is in Badger Park, the facilities of which include a swimming pool, tennis court, and shelter house. Admission to the mine is $1.00 for adults and 50¢ for persons under 18 years. The mine is open from May 1 to November 1, 9 a.m. to 5 p.m. 12

Wis. 133.—On the west side of the road on the south side of Potosi is the St. John lead mine, which operated between 1827 and 1870 and which has now been opened to visitors (map location 13). Entrance is by an adit (tunnel) high on the face of a bluff. One can observe the tunnels as dug by the pioneer miners. Admission is $1.00 for adults and 50¢ for 6- to 12-year-olds. Tours are conducted daily from 10 a.m. to 5 p.m., May 30 to Labor Day. 13

GHOST TOWNS AND HISTORICAL SITES

U.S. 151, Wis. 81.—Platteville's mining museum presents a comprehensive history of mining in the area (map location 14). The museum, housed in a school erected in 1858, contains many artifacts and tools used by the pioneer miners in the area. Beneath the museum are the tunnels of an ancient lead mine operated about 1826. Plans are underway to include the mine as part of the museum tour in the future. Museum admission is free. It is open year-round, 7 days a week, 9 a.m. to 4 p.m. 14

U.S. 151.—In Dodgeville, 0.4 mile east of the highway on Spring Street, is the well-preserved hearth of a Scotch-type furnace, erected in 1876 (map location 15). This type of furnace was used to smelt lead ores. Several of these furnaces were in use throughout the area during that period. 15

U.S. 14.—Just east of Spring Green is the Tower Hill State Park, the site of an early shot tower (map location 16). A vertical shaft was dug at the edge of the cliff. Molten lead, poured over a screen in a tower above this shaft, formed droplets that cooled into spheres in the fall to the water basin below. The shaft is in good condition and is an excellent example of early shot manufacturing. 16

FOR MORE INFORMATION WRITE OR VISIT

Federal Bureau of Mines Liaison Office, P.O. Box 1660, Twin Cities, Minn. 55111.

State Geologist, Wisconsin Geological and Natural History Survey, University of Wisconsin—Extension, 1815 University Avenue, Madison, Wis. 53706.

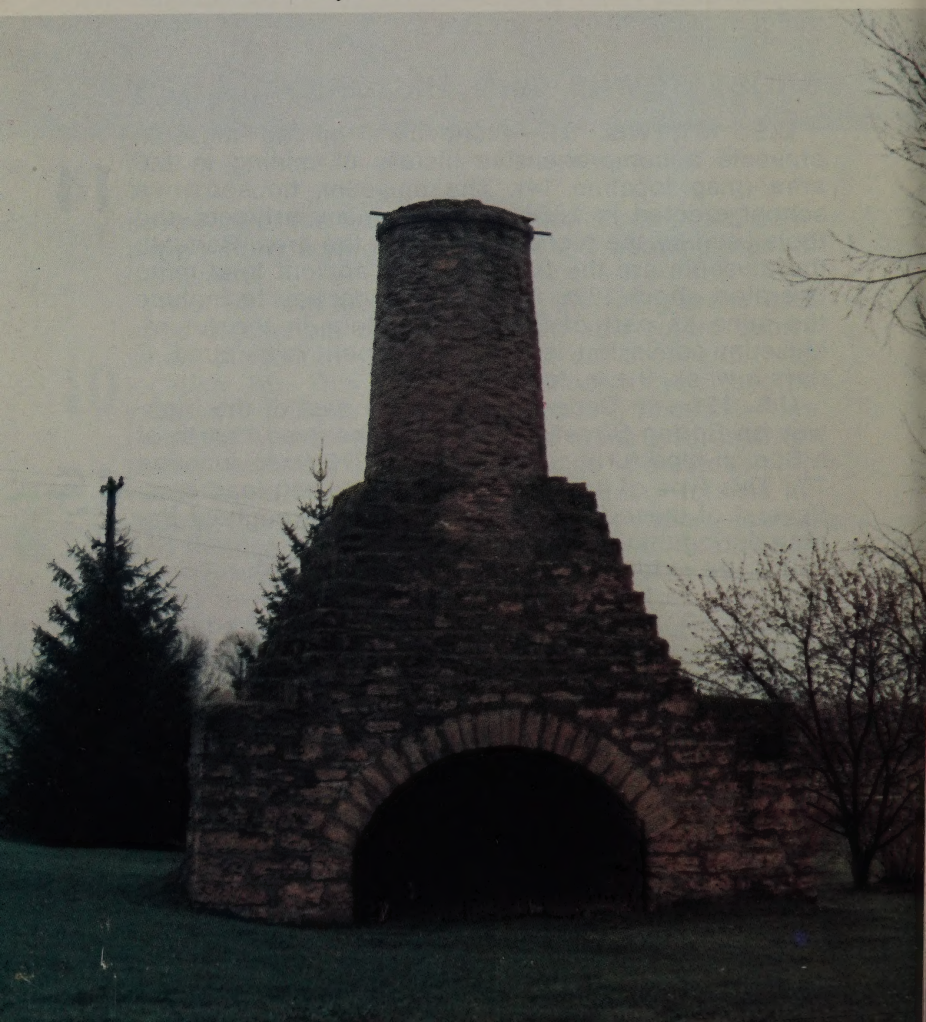
SELECTED REFERENCES

Geologic Map of Wisconsin. Wisconsin Geological and Natural History Survey, Madison, Wis., 1972.

Landforms of Wisconsin. Wisconsin Geological and Natural History Survey, Madison, Wis., 1949, map.

Wisconsin Glacial Deposits. Wisconsin Geological and Natural History Survey, Madison, Wis., 1956, map.

Scotch hearth lead furnace erected in 1876 at Dodgeville, Wis.



BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

DATE DUE

HD 9506 .U63 N6
U.S.D.I.-Bureau of Mines SP
Mining and Mineral Operations
in the North-Central States

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.